Macdonald School, Guelph. Section of Class of Teachers, Summer Course, 1917

ONTARIO
TEACHERS' MANUALS

ELEMENTARY AGRICULTURE AND HORTICULTURE

AUTHORIZED BY THE MINISTER OF EDUCATION

TORONTO
WILLIAM BRIGGS

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PREFACE

This Manual is intended particularly for the use of the teacher. The work herein outlined is expected to meet the needs of busy teachers who may not have had much training in, the fundamental principles of the sciences underlying agriculture. Some training, of course, is necessary, but the wide-awake teacher who is willing to put forth some personal effort may accomplish something worth while, if the lessons here planned for his guidance are followed out.

The topics are selected so as to be adapted to the average rural school of one teacher, and are sufficiently elastic to be made use of in any part of Ontario, even in the cities.

The seasonal arrangement is made use of because, unlike many other subjects, practical agriculture must necessarily follow the seasons. The various duties pertaining to the farm should be studied when they occur, not a month before or a month after.

The lessons are outlined so as to require the laboratory method, and the pupils are expected to *do* agriculture, not simply *read about* it. Moreover, most, if not all, of the lessons are of such a character as can be taken up in a half-hour period, with a little forethought, or they can be left off, and concluded during a class period a day or so afterwards.

It is not intended that each school should complete all the lessons given, nor is it intended to confine the classes strictly in every case to these lessons. If the teacher wishes to undertake practical exercises, other than those outlined, which he considers suitable to the locality, there could be no objection offered, so long as such exercises fall within the Course of Study.

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AGRICULTURE AND HORTICULTURE

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The Orchard.—Surveys of fruit-growing in locality
Study of fruit-tree twigs
How to plant trees and set out an orchard
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The School.—Beautifying the school grounds and the roadside in front

School Progress Clubs.—Organization and maintenance

FORM IV

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The School.—Beautifying the school grounds and the roadside in front

School Progress Clubs.—Organization and maintenance

ELEMENTARY AGRICULTURE AND HORTICULTURE

I. NATURE STUDY AND AGRICULTURE

NATURE STUDY AND THE CHILD

Nature study begins in infancy and continues throughout life. As a school subject it endeavours to establish a sympathetic relationship between the child and his environment, which always furnishes the material to be selected for study. This material may have a practical bearing or not, but the practical aspect is not the chief consideration. The children themselves are the first consideration. A good topic for one child might be unsuitable for another. The child should be guided along his own inclinations with problems and material that interest him, without any special regard to the utility side. The aim is to train the child, who is, at the same time, gaining knowledge for the pleasure of gaining it. There is no time in life when this process of development breaks off, but there is a time when the practical bearing of many problems of nature can be turned to account in making a living; when problems of soil, crops, poultry, etc., as they relate directly to making a living, can be understood. This is the time when agriculture should be introduced.

NATURE STUDY AND AGRICULTURE

Nature study may lead directly to agriculture, but there is necessarily no distinct line of demarcation between them. It would be difficult to determine how old the child should be before the practical bearing of nature problems can be profitably begun. In Ontario this period is approached about the time the pupil reaches Form III. At this stage agriculture is introduced, not exactly as a continuation of nature study, but in addition to it. Of course, the study of elementary agriculture is also, to some extent, nature study, but it must have always some direct bearing upon agricultural operations. And it must be kept in mind that agriculture is really agriculture and not agricultural nature study.

There is a great deal of misapprehension in regard to the relative position of the two subjects—Nature Study and Agriculture. Some say they are one and the same: "It makes no difference whether we call it elementary agriculture or agricultural nature study, it is one and the same thing". Another says they are antagonistic: "Nature study and school gardens must be got out of the schools before elementary agriculture can be got in". Both views are extreme, and neither is, therefore, serviceable.

For example, the common centipede would form the basis of an excellent lesson in nature study, but would be without value in agriculture. The stars are always interesting as nature study, but should find no place under agriculture. Beautiful snow crystals are excellent material for nature study, but useless in agriculture. The geographical origin of the breeds of heavy horses would be a poor lesson in nature study, but a good lesson in agriculture. An experiment to show that the formalin treatment of oats prevents smut would be unsuitable for nature study, but an excellent lesson in agriculture. The making of a hotbed could scarcely be used as a lesson in nature study, but it would be a very useful lesson in agriculture. Certain problems arising out of school-garden work would provide excellent lessons in both nature study and agriculture.

The preliminary training in nature study is exceedingly useful as an introduction to agriculture, but it is not essential. The chief value of this preliminary training is not so much the knowledge obtained, as it is the foundation laid for methods of investigation.

The topics selected for study in agriculture should be those which appeal to the pupils. The extent to which such topics are developed will depend upon the age and the ability of the members of the class, but no subject can be exhausted. The work must be almost entirely practical; it must be the study of real things.

By the time the pupils have reached Form III, they are, as has been stated, sufficiently developed to understand many of the practical applications of the principles underlying agriculture. The subject should then be introduced. Accordingly, there should be a place on the school programme for both Nature Study and Agriculture.

METHOD AND AIM

The method of teaching Agriculture must be almost wholly the laboratory method, dealing with material familiar to the pupils, and it should be scientific as far as it goes. The development of the individual is of more importance than the giving of information; consequently, the kind of material used for study is not so important as the method employed. In one district a certain kind of material may be made use of with as good results as another kind of material in another district. The subject is applicable to all parts of the province, and the problems outlined in the seasonal course are sufficiently varied to meet the general needs of all schools.

The aim in teaching agriculture is to make the pupils realize the fundamental principles underlying farm operations, to render them capable of thinking and of investigating for themselves, and to show them that live stock, soil, and crops furnish problems calling forth the best ability of man. The study of agriculture pursued by this method and with this aim will aid vastly in the pupils' mental development and will immeasurably increase their pleasure in school and farm life. This being the case, fewer of those who have been brought up on the farm will be inclined to leave it.

II. SUGGESTIONS FOR THE TEACHER

It is of the greatest importance that the teacher should make an effort to qualify himself as fully as possible to teach agriculture. Consequently, advantage should be taken, by every teacher who expects to teach this subject, of the short courses of instruction provided by the Department of Education at the Ontario Agricultural College.

PROVISION MADE ON THE TIME-TABLE

As is the case with other subjects, provision for teaching the subject should be made on the time-table at such a time as may suit the convenience of the teacher. The subject deserves a place on the regular programme, and should not be placed after four o'clock or on Saturdays, unless both parents and pupils are willing. Occasionally it may be advisable to make provision for some work which could not be done during the regular school hours, but this work should not be made in any sense obligatory.

THE WORK MUST BE PRACTICAL

The method of managing classes requires some forethought, because in many respects it will be different from that used in most of the other classes. Since the work is to be made as practical as possible, the laboratory method will be necessary in the majority of cases. This method is especially useful for young pupils, because it enables them to use their senses—to see, to feel, to taste—to do things.

SUITABLE STORE-ROOM ACCOMMODATION

The teacher should see that suitable store-room accommodation is provided for the equipment and for the tools. The tools should be distinctly and permanently marked (red paint is suggested), in order to guard against loss. The care of the tools should always be considered an important part of the garden work.

LABORATORY AND ILLUSTRATIVE MATERIAL

Wherever possible the material or specimens for class use should be brought to the class-room by the pupils concerned. Forethought on the part of the teachers will be necessary, in order that the material may be on hand for the exercises on the schedule. Certain kinds of material may be retained for further study, as, for example, ears of corn and heads of grains. Wherever grain is kept, special precautions must be taken to guard against destruction by mice. Specimens hanging from the ceiling are always safe. Samples of all kinds of grains or seeds may be kept in glass jars. The same may be said of commercial fertilizers, stock foods, etc. The success of the teacher will depend, to a considerable extent, on the convenient arrangement of material.

USE OF NOTE-BOOKS

A systematic record of their observations should be kept by the pupils. A note-book for agriculture alone should be provided. But the teacher will make a mistake, a serious mistake, if he dictates formally, to any great extent, the notes to be written by the pupils. In some cases, as for example, a recipe for grafting wax, it may be necessary to dictate; but the note-book should be a record of the pupils' observations and the result of their efforts. Special forms of note-taking as indicated under School Progress Clubs, p. 147, will be useful also.

USE OF BULLETIN BOARDS

A convenient way of connecting the monthly exercises of the class with the operations of the home is to have a bulletin board, on which should be placed, for a time, new bulletins received from Ottawa or Toronto. In addition to this, there should be placed on this board, for a short time, photographs of record cows, results of standing crop competitions, local school prize lists, etc. A committee of the School Progress Club should be given a general supervision over the bulletin board. This board might properly include a shelf or shelves, devoted exclusively to the more important bulletins, or to cuttings dealing with topics of interest to the community.

USE OF REFERENCES

Since there is no text-book prescribed for the use of pupils, considerable reference should be made to text-books in the library and to bulletins on the shelves. Where a matter of especial interest is under discussion, pupils should be directed to works of reference and encouraged to seek information for themselves. For example, the subject of discussion might be a method of preventing horns from developing on calves, or it might be the formalin treatment for potato scab, or some other subject of importance upon which detailed information is required.

The pupils should be trained to find for themselves such information as may be required.

COMBINED CLASSES

A large number of schools in the Province have a small attendance in Forms III and IV, and, where these two forms do not exceed fifteen, or even twenty pupils, the two classes might well be combined for the sake of convenience and economy of time. In such cases of combination the work arranged for Form III should be undertaken one year, and that for Form IV the next, and so on. In this way the whole ground will be covered, with good results. In the exercises outlined for the different months of the two years, there may, in some cases, appear to be a repetition, but this repetition is quite suitable when the classes are combined as indicated above. Where the classes are kept separate, as they will be in the larger schools, some combination may be made for certain topics, as, for example, in the manipulation of the hotbed and the cold frame.

SELECTION OF EXERCISES

As stated in the Preface, it is not intended that each class should complete all the work laid down in the monthly schedule. A small amount well done will produce better results than a large amount badly done. Some classes can do more work than others, and it is for the teacher to decide how much should be undertaken. As will be noticed in many of the exercises, the teacher is expected to ask the pupils to bring material from home. This form of lesson is doubly effective, for it connects the occupations of the homes with the lesson study. In an apple-growing district, special attention should be given to spraying, fruit-packing, pruning, grafting, etc., and less attention given to corn-growing. In a corn-growing district this order should be reversed.

ARITHMETICAL PROBLEMS

The month of December, being, as it were, the closing month of the agricultural year, is a suitable time to devote to the solving of problems arising out of the various farm activities. It should be noted, however, that, although the problems in this Manual are placed together in a group, some of them might properly be undertaken at the close of the exercise out of which the problems arose. Here and there problems are arranged in this way, but it is still thought best to collect in a group such problems as might be undertaken at a time when there is a minimum of important farm operations. As far as practicable, the problems are so arranged as to be connected directly with the duties actually pertaining to one or other of the branches of farm work.

PROVISION FOR THE CARE OF THE SCHOOL GARDEN DURING VACATION

The management of the school garden during the summer vacation will require considerable forethought, especially where the teacher's home is at some distance from the school section. Adequate provision for such care as may be required should be made by the teacher before the close of the school in June. The following suggestions may prove useful: (*a*) The management may be undertaken by the School Progress Club; (*b*) each of the classes of Forms III and IV could take charge in alternate weeks, by visiting the gardens at least once, and doing such work as might be necessary; (*c*) each individual might be held responsible for his or her plot; (*d*) some man or woman in the Section might be asked to visit the garden at stated times (four or five times during vacation), when the pupils would be there by arrangement, for an hour or two, to do the necessary work, these days being made attractive by having some games or sports after the garden work; (*e*) arrangements might be made with some responsible person to have the necessary work done and paid for (to this method there are many objections); (*f*) by far the best method for summer management is to have the teacher himself visit the school with the pupils, see that the work is done, give such explanations as may be useful while on the ground, and have games and sports as part of the programme; this method, however, is feasible only when the teacher lives in the Section or near it.

LIBRARY BOOKS IN USE DURING THE SUMMER

If the teacher will take the trouble to loan the agricultural books belonging to the school library for the period of the summer vacation, it will be productive of good. Books lying on the shelves of the school for two or three months are doing no service to any one. It is not expected that every one will read these books from cover to cover, but it is reasonably certain that there will be found here and there suggestions and paragraphs of value to the farmer. For example, it may be a statement in regard to silo filling, the formalin treatment for oat smut, spraying of garden roses, the importance of underdrainage for land, etc. The point is that books are fulfilling their mission only when they are in circulation.

III. EQUIPMENT

Each school should be provided with equipment sufficient to enable the teacher to do successful work. As this is at present paid for in full, in the form of grants from the Department of Education, there is no excuse for lack of equipment.

The following list of apparatus is recommended as suitable for elementary classes in Agriculture and is intended to be suggestive:

GENERAL

	(Price estimated)
Three small glass funnels	$0 30
One half dozen glass tumblers	30
One half dozen glass fruit jars (sealers)	40
One dozen large test-tubes (1 in. by 6 in.)	30
Measuring cylinder (graduate) 100 c.c.	75
Hydrometer, Baumé (for heavy liquids)	1 00
Hydrometer jar	45
Spirit lamp (with wood alcohol)	40
Thermometer, chemical, both C and F (2 at 30c.)	60
Small bottle of hydrochloric acid	15
Small bottle of iodine (in K I)	15
Two litmus pads at 5c.	10
The following, dry, in large-mouthed, cork-stoppered bottles: Sodium nitrate, calcium phosphate, potassium chloride (or sulphate), copper sulphate, washing soda, baking soda, starch, lime, sulphur, 10 cents each	90
Filter paper	10
Soup-plates and saucers, a dozen each	60
Flower-pots, 3 dozen 4 in.	1 08
Flats (boxes for planting seed)	20
Apple box to demonstrate packing	20
Surveyor's chain	2 50
Rain gauge	2 00

Garden tools as may be needed: 6 hoes, 6 rakes, 3 spades, 2 spading forks, 1 combined seeder and wheel cultivator, 1 hand cultivator, 6 digging trowels, 1 weighing scales, 1 mattock, 1 lawn-mower (when necessary), 1 garden line (binder twine will do), sufficient corner stakes (these should be made by the class), sufficient labels (these should be made by the class).

In addition to the foregoing equipment, it would be very useful to have a work-bench with vise and set of tools, to do such work in farm mechanics as may be necessary to make the garden work effective.

SPECIAL

For special purposes, selections from the following may be made: (The teacher should write to a dealer for prices.)

For Poultry—
- Model of feed hopper
- Trap nest
- Model of hen or chicken-coop
- Incubator (may be borrowed)

For Beekeeping—
- Standard Langstroth hive, complete
- Smoker
- Colony of bees in 10-frame hive

For Field Crops—
- Set of grain measures
- Machine for treating grain for smut
- Samples of grains—wheat, rye, barley, buckwheat, rice in the hull, oats, etc.
- Fertilizers
- Weed seeds

Horticulture
- Pruning and grafting tools
- Hand-spraying outfit
- Hotbed (may be built permanently)
- Cold frame
- Combined wheel cultivator and seeder

For Dairying—
- Lactometer
- Babcock milk tester
- Milk scales
- Milk pail (modern)
- Butter utensils, for illustration

THE LIBRARY

RECOMMENDED BOOKS

The following books should be in the library of every school in which Agriculture is taught:

Mushrooms. Atkinson. Henry Holt & Co., Boston. $2.50.
Agriculture for Beginners. Burkett, Stevens and Hill. Ginn & Co., Boston. 80c.
Canadian Dairying. Dean. Wm. Briggs, Toronto. 90c.
Swine Husbandry, Day. Lippincott Co., Philadelphia. $1.75.
Elementary Principles of Agriculture. Ferguson & Lewis. Ferguson & Co., Chicago. $1.00.
The Soil. King. Macmillan Co., Toronto. $1.50.
Vegetable Gardening. Green. Webb Pub. Co., St. Paul, Minn. $1.00.
Bacteria in Relation to Country Life. Lipman. Macmillan Co., Toronto. $1.50.
Types and Breeds of Farm Animals. Plumb. Ginn & Co., Boston. $2.00.
The A, B, C, and X, Y, Z, of Bee Culture. Root. A. I. Root Co., Medina, Ohio. $1.75.
Insect Pests of Farm, Garden, or Orchard. Sanderson. Macmillan Co., Toronto. $3.00.
Agricultural Arithmetic. Stratton and Remick. Macmillan Co., Toronto. 50c.
Essentials of Agriculture. Waters. Ginn & Co., Boston. $1.25.
Elements of Agriculture. Warren. Macmillan Co., Toronto. $1.10.

(For a more extended list see Circular 13, 1917.)

ONTARIO AGRICULTURAL COLLEGE BULLETINS

Each school should be in close touch with the Ontario Agricultural College, and all the Bulletins issued by that Institution should be in every school where Agricultural classes are conducted. In cases where a Bulletin is of special interest to the community, some instruction should be given on the subject concerned, and a copy of the Bulletin might then be secured for each pupil. For such publications write to the Publications Branch, Department of Agriculture, Toronto.

BULLETINS PUBLISHED BY THE ONTARIO DEPARTMENT OF AGRICULTURE, TORONTO

Serial No.	Date	Title	Author
205	Sept. 1912	Dairy School Bulletin (No. 172 revised) .... I. Cheese-making and Butter-making	Staff of Dairy School
20.	Dec. 1912	Ice-cold Storage on the Farm.	R. R. Graham
208	Jan. 1913	Farm Poultry and Egg Marketing Conditions in Ontario County	J. H. Hare T. A. Benson
209	Mar. 1913	Farm Forestry (No. 155 revised)	E. J. Zavitz
210	Mar. 1913	Strawberry Culture and the Red Raspberry	F. M. Clement
211	Mar. 1913	Fruits Recommended for Ontario Planters (No. 179 revised)	Fruit Branch
213	April 1913	Bee Diseases in Ontario	Morley Pettit
216	Oct. 1913	Box Packing of Apples	E. F. Palmer
218	Dec. 1913	Birds of Ontario (No. 173 revised)	C. W. Nash
219	Jan. 1914	The San José and Oyster-Shell Scales	L. Cæsar
220	Mar. 1914	Lightning Rods	W. H. Day
221	April 1914	Food Value of Milk and Its Products	R. Harcourt
222	April 1914	Currants and Gooseberries ..	E. F. Palmer
223	May 1914	Fertilizers	R. Harcourt A. L. Gibson
224	Sept. 1914	Greenhouse Construction	S. C. Johnston
225	Dec. 1914	Swine	G. E. Day
226	Dec. 1914	Plum Culture in Ontario	F. M. Clement
227	Jan. 1915	Cherry Fruit-flies	L. Cæsar G. J. Spencer
228	Feb. 1915	Farm Crops: Experiments at O.A.C.	C. A. Zavitz
229	Feb. 1915	Smuts and Rusts of Grain Crops	J. E. Howitt R. E. Stone
230	Mar. 1915	The Cherry in Ontario	E. F. Palmer
231	April 1915	Vegetable Growing	S. C. Johnston
232	April 1915	Field Beans	C. A. Zavitz
233	May 1915	Natural Swarming of Bees ..	Morley Pettit
234	Aug. 1915	Co-operative Marketing Associations	F. C. Hart
235	Feb. 1916	Sweet Clover (Melilotus) ...	H. L. Fulmer
237	Mar. 1916	The Grape in Ontario	F. M. Clement

BULLETINS—*Continued*

Serial No.	Date	Title	Author
238	May 1916	Lime and Its Use in Agriculture	R. Harcourt
239	May 1916	Potatoes	C. A. Zavitz
240	June 1916	Bacterial Diseases of Vegetables	D. H. Jones
241	July 1916	Peach Growing in Ontario	F. M. Clement A. S. Harris
242	Dec. 1916	Diseased Mouths a Cause of Ill-health	Ont. Dental Soc.
243	Dec. 1916	Nature Study, or Stories in Agriculture	O.A.C. Staff
244	Dec. 1916	Hints for Settlers in Northern Ontario	W. G. Nixon R. H. Clemens
245	Dec. 1916	Food Values	R. Harcourt
246	Jan. 1917	Suggestions on Feeding Stock	G. E. Day
247	April 1917	Farm Poultry (No. 217 revised)	W. R. Graham F. N. Marcellus
248	April 1917	Pruning	F M. Clement F. S. Reeves
249	May 1917	The Pear in Ontario	F. M. Clement O. J. Robb
250	July 1917	Insects Attacking Fruit Trees	Lawson Cæsar
251	July 1917	Insects Attacking Vegetables	C. J. S. Bethune

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SEASONAL COURSE FOR FORM III

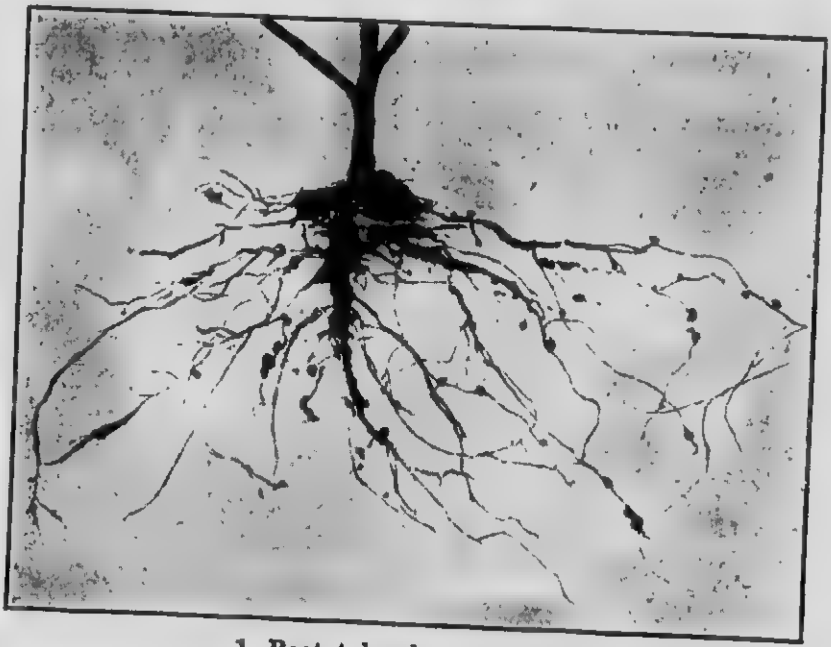
(First year of two-year Course)

AUTUMN WORK OF FIRST YEAR

SEPTEMBER

EXERCISE 1:

Have the pupils bring sweet-peas and red-clover plants, including roots,[1] to the class. Compare the leaves of the two plants and note the differences. Look for small *nodules* on the roots (see Figure 1). Explain to the class in mere outline the relation of these nodules to soil fertility. Contrast and compare the flowers and the stems.

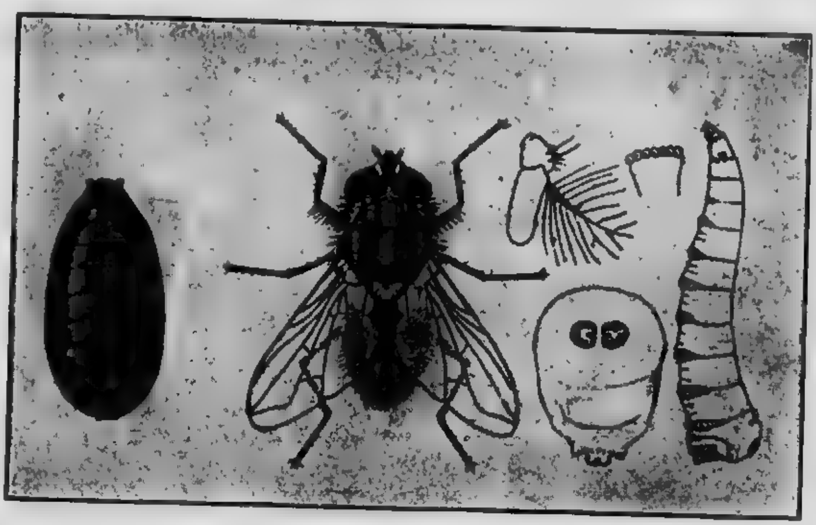


1. Root tubercles—soy bean

Make a flat drawing of a leaf of each of the two forms. Leaves are the chief organs that have to do with the manufacture of food material for the plant.

EXERCISE 2:

Compare the pods of the two plants. Look for the seed. Make a flat drawing of a pod and a seed of each plant. If the seed is mature, or nearly so, save some for planting the following spring. The seed contains the minute plant. Ask the pupils to examine the roots of other similar plants. (Legumes) Why should legumes have a place in crop rotation?



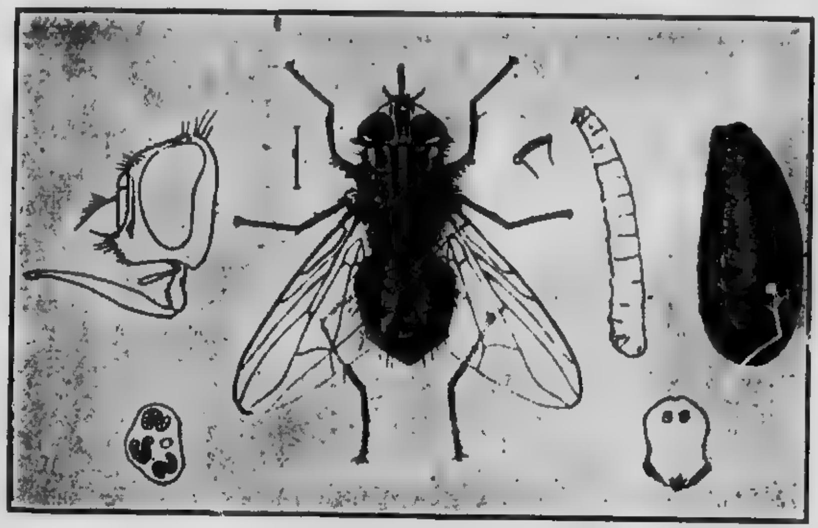
2. House-fly

EXERCISE 3:

Ask the pupils to note where house-flies live and how they procure their food. If possible secure some of the larvae, and also some "fly blows" (eggs). Point out that the life history of the fly includes four stages—egg, larva, pupa, adult. Show how the house-fly is an important agent in spreading diseases of human beings. Explain the importance of destroying the breeding-places of the house-fly. Flies breed in filth of various kinds, generally in horse manure. (See Figures 2 and 3.)

EXERCISE 4:

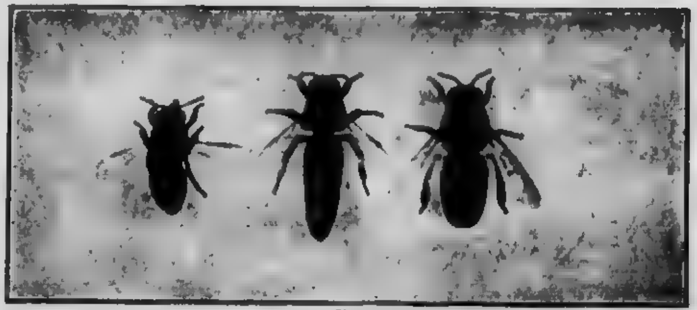
Have the pupils secure a few honey-bees. Place them in a bottle, and observe. Describe as in the case of the fly. Compare the wings, the eyes, and the body with those of the fly. If a drone bee and a worker can be secured, so much the better. Compare these two. (See Figure 4.) Do not go into too many details; only those which will be fully appreciated should be considered.



3. Stable-fly

EXERCISE 5:

Show samples of the "comb" and of the "foundation". Call attention to the shape of the cells and ask the pupils



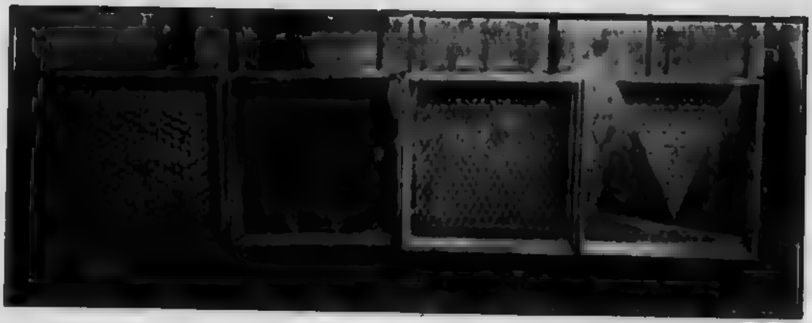
From Beekeeping Dept., O.A.C.

4. Worker, queen, drone

to draw an outline of a few cells. Explain "capping" and "bee bread", and point out that the bee has four stages similar to those of the fly. (See Figure 5 and *Ontario Agricultural College Bulletin, 233.*)

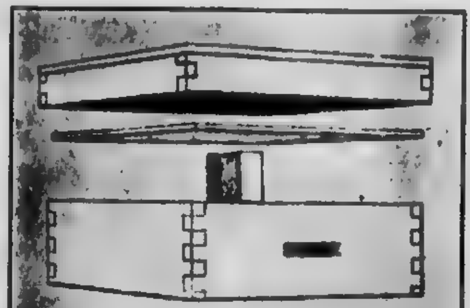
From Beekeeping Dept., O.A.C.

5. Queen cell and capped brood



From Beekeeping Dept., O.A.C.

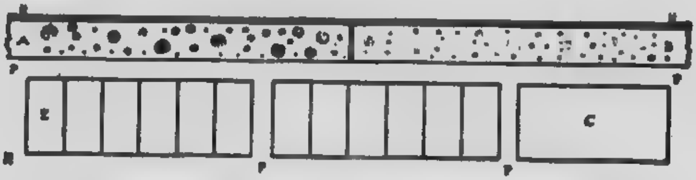
6. Section fitted with foundation and containing comb honey. One section capped



7. Langstroth hive, showing parts separated (After Philips)

Exercise 6:

Ask the pupils to bring potato beetles to the class for study. Along with the beetles should be brought some half-eaten potato leaves. Compare the feeding habit of bees, flies, and potato beetles; their food, and how each secures it. Point out, in the form of written notes, the relations of each to the welfare of human beings. Have the pupils examine particularly the methods of feeding. (*Ontario Agricultural College Bulletin, 251*)



8. H.H. represents a fence along the north side of the school grounds—A. plot for perennial flowers; E. plot for wild flowers; C. community plot; E. individual plots 8 x 4 feet; P. paths 2 feet wide. Space economized. Drawn to scale. This is one of the simplest forms of school garden, and can be adapted to any school. Arranged to run along one side of the grounds. Adapted for 12 pupils.

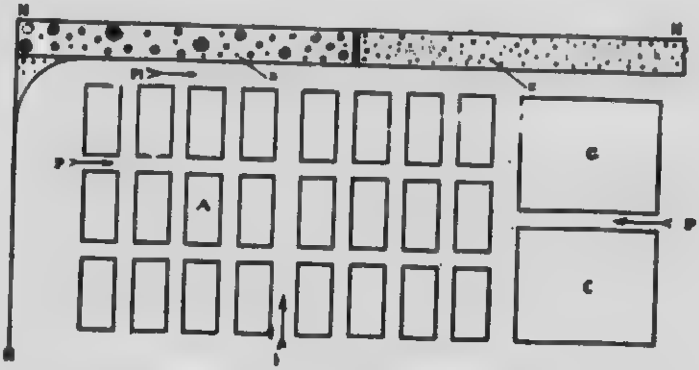
AUTUMN MANAGEMENT OF SCHOOL GARDEN

If the school has not had a garden previously to this and the Board is willing to proceed, the teacher should make preparations for it and read carefully the Section on School Gardens, page 135.

Exercise 7:

After having decided upon a location, either upon the present school grounds or on a plot adjoining, the teacher will bring the pupils out to the land and have them measure it carefully and make notes in regard to (*a*) kinds of plants growing in the plot, and (*b*) the character of the soil, and the relation of the plot to sunlight, fences, trees, etc.

When arrangements have been made to have the land ploughed (which should be done in the fall) and the ploughman is on the ground, the pupils should be brought out to the plot for fifteen minutes, to note (*a*) the depth and width of the furrow, (*b*) whether the weeds and grass are well turned under, and (*c*) the character of the soil. If the weeds and grass have been well covered, it would be just as well to leave the land in the rough; if not, it should be harrowed over lengthwise. In either case a dressing of barnyard manure should be given in November, which should be disked in, or dug under, in the spring.



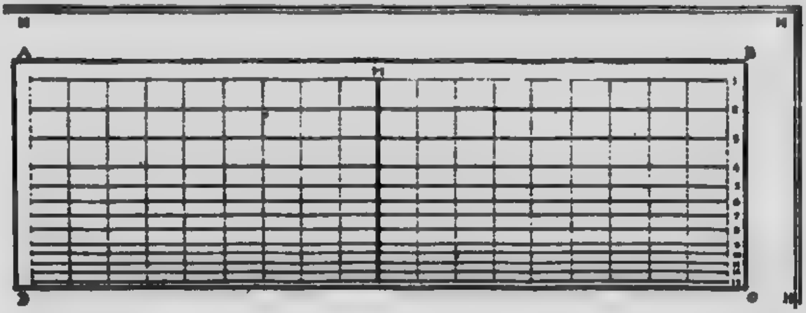
9. H.H.H. fence; D. plot for perennials; E. plot for wild flowers; A. individual plots 4 by 8 feet; C. community plots; P. path two feet wide. Drawn to scale. This plan is wasteful of space and is adapted to a corner of the grounds. Suitable for 24 pupils.

Where a school garden has been in operation, a lesson or two should be given in harvesting the crop and in the preparation for winter.

EXERCISE 8:

If each pupil has been promised a share in the products, the class should be taken to the garden and the division made there. Secure some mature samples of beets, the best that can be had, and ask the pupils to dig them, being careful not to destroy the rootlets. Cut off the tops, but not close to the root. These individual beets should be preserved for planting the following spring, to produce seed later.

Deal similarly with turnips, carrots, and parsnips; and preserve them carefully in the cellar.

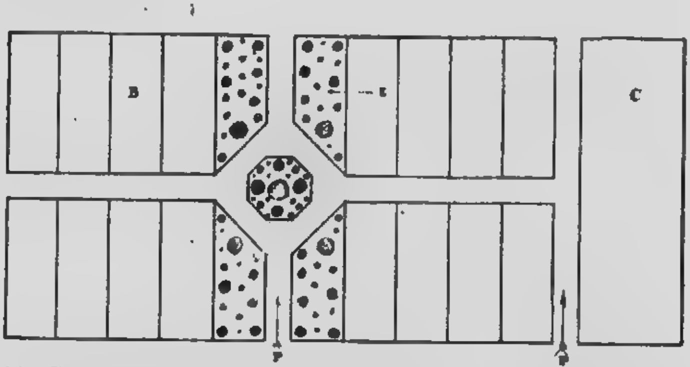


10. H.H.H. fence; A.B.C.D. a plot without paths except at the edges; M. middle line dividing the garden into two parts, one for Form III and one for Form IV; 1 and 2 represent rows of corn; 3, row of tomatoes; 4 and 5, rows of potatoes; 6, 7, 8, rows of cabbage, cauliflower, and beans; 9, 10, 11, rows of parsnips, beets, carrots; 12 and 13, rows of lettuce and radishes. The distance from 1 to 2 is 3 feet. Drawn to scale. Rows run right through from end to end, and each pupil has a portion of each row. Suitable for 18 pupils.

When the crop is harvested, the amount of crop should be weighed and the gross value per acre calculated. Prices may be had from the local dealer.

Exercise 9:

Ask the pupils to bring to the class eight or ten kinds of weeds. Most of the weeds will probably belong to the Composite family, and these should be singled out from the rest. Some of the characteristics of this family may be noted, especially those which enable the plants to persist as weeds. An attempt should be made to name all the weeds in the locality and to become familiar with them. (See list below.)



11. Garden, with some ornamentation, suitable for the centre of a plot; B. plot 6 x 16 feet; C. community plot, 12 x 35 feet; P. path, 3 feet wide; E. perennials. Space economized. Drawn to scale. Suitable for 16 or 32 pupils.

WEEDS

The weeds named in the following lists are common everywhere in Ontario. Pupils should learn to recognize these weeds and to compare them with others found growing in the same ground. One plant may be a particularly bad weed in one place and less harmful in another.

The weeds found to be especially harmful are:

(1) In grain fields—

Wild mustard, Canada thistle, wild oats.

(2) In hay fields—
Curled dock, ox-eye daisy, daisy fleabane, bladder campion.

(3) In hoed crops (turnips, potatoes, corn, etc.)—
Foxtail, couch-grass, perennial sow-thistle.

(4) In lawns and pasture—
Dandelion, narrow-leaf plantain, yarrow.

(5) Around door-yards—
Knot-weed, broad-leaf plantain, round-leaf mallow.

(6) In cultivated gardens—
Purslane, shepherd's-purse, pigweed, lamb's quarters.

(7) Around fences and buildings—
Burdock, mayweed, ragweed, beggar-ticks.

There are many other noxious weeds, and some of those mentioned in one list may also belong to another.

The pupils should be asked to collect other weeds and to add to these lists. There is a great variety of weeds found along roadsides and in waste places but, as the roadsides are not cultivated nor the crop harvested, the weeds are relatively less important. In some places the farmers have taken down the fence along the roadside and cultivated up to the wagon track. This is a good practice, for it reduces the weeds and increases the area for the production of crops.

EXERCISE 10:

If there is a School Fair in the neighbourhood, a weed-seed collection might be prepared by the pupils. To do this with good results, select the plants and put them, lying loose on a newspaper, in a dry place. When the plant dries the seeds drop out, or they may be thrashed out by beating the plant on the floor. The seeds fall upon the paper, and may then be placed in vials and labelled. This may be done at home, but the seeds should then be brought to the class and some comparison should be made regarding the different kinds of seeds. (See Figure 12.)

12. Weed-seed collection—showing method of preserving and labelling

Exercise 1:

October

Weeds.—Discuss the eradication of weeds from gardens, lawns, roadsides, and fields. From weeds which have been gathered by the pupils, point out those injurious in (*a*) fields, (*b*) gardens, (*c*) lawns, (*d*) door-yards.

Exercise 2:

Have the pupils bring carrots and beets to the class. These should be examined as to structure, colour, taste, etc. Bring out the distinctions between perennial, annual, and biennial plants.

Exercise 3:

The following plants should be brought to the class-room—goldenrod, perennial sow-thistle, purslane, and shepherd's-purse. Point out the methods that should be pursued in combating these weeds.

Exercise 4:

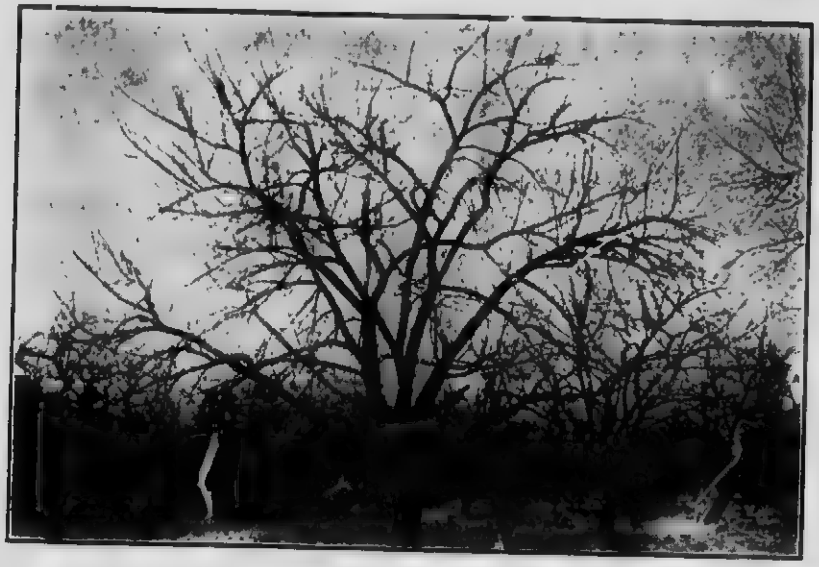
Ask the pupils to bring apples from home. If any of the apples show "scab", call attention to this disease and discuss it with the class. Cut the apple open, so as to see the core and the relation of the parts shown in the section. Make a drawing to show a cross section of this fruit. Taste the apple and test it with litmus for acid.

Exercise 5:

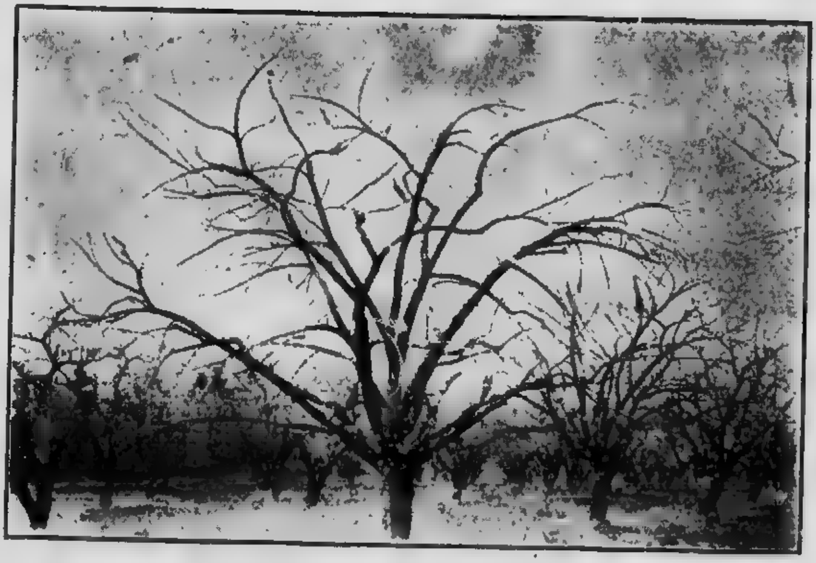
Have the pupils bring twigs of apple-trees from the orchard at home. Distinguish the fruit-buds from the leaf-buds. Show by demonstration on the twigs how scions for grafting should be made. (See illustrations and also *Essentials of Agriculture*, Waters, pages 43-4.)

Exercise 6:

Bring branches of an apple-tree to the class and have the pupils prune them. Explain the importance of cutting close to the branch. Explain "healing" and "cork formation". (See Figures 13, 14, and *Essentials of Agriculture*, Waters, page 270.)



13. Before pruning



14. After pruning

Exercise 7:

Fruit survey.—Ask the pupils to obtain information regarding the acreage of apples, plums, pears, peaches, or other fruit grown at their homes. From the information thus secured a survey of the Section could be made. Pupils are quite willing to collect information of this character, and parents will give them the needed assistance.

Exercise 8:

Similarly, the pupils should be asked to count the apple-trees or other fruit-trees at their homes. A lesson dealing with these matters may be useful to the whole Section. The teacher should communicate with other teachers in neighbouring Sections and make comparisons in regard to this survey.

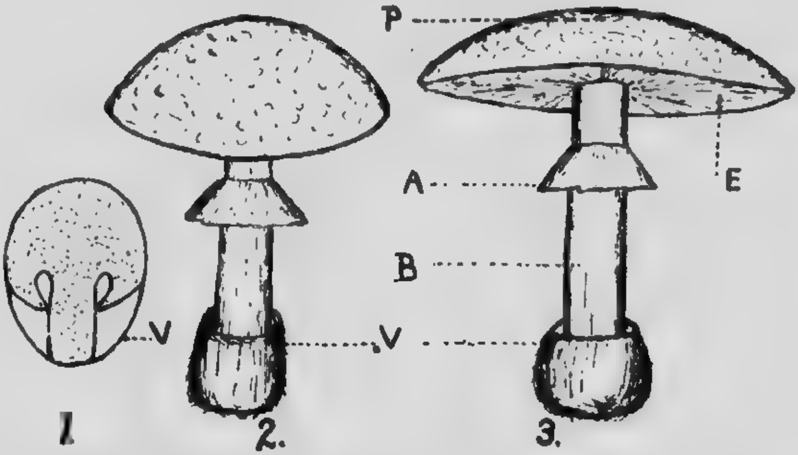
Acreage in small fruits, such as raspberries, strawberries, etc., may be dealt with as in (7) above.

Exercise 9:

Mushrooms.—Have the pupils bring specimens of the different fleshy fungi to the school-room. They will probably have (*a*) those of the form of the ordinary mushroom, (*b*) puff-balls, and (*c*) bracket fungi—three groups readily distinguished. The mushroom group is the only one of the three that contains poisonous species, and may be subdivided into five divisions according to the colour of spores produced. This colour is indicated by the colour of the gills, which may be white, black, ochre, purple-brown, or pink. The deadly-poisonous forms are found in the first division; consequently, unless absolutely certain, no mushrooms which have white gills or spores should be eaten. The poisonous fungi of the white-spored division belong to the genus *Amanita* which has the following characteristics—the ring around the stem, the cup at the base, and the volva, or veil, over the cap. However, it is wise to avoid all the white-spored species. None of the ochre-spored species is good and they should all be avoided. The common edible mushroom belongs to the pink-spored division, and it is not known that any of the black, purple-brown, or pink forms are poisonous. None of the puff-balls is poisonous. (See illustrations.)

In a general way all mushrooms decay very quickly and should not be eaten when stale, because ptomaine poisons, due to partial decomposition, may develop, and, if they do, serious results may follow.

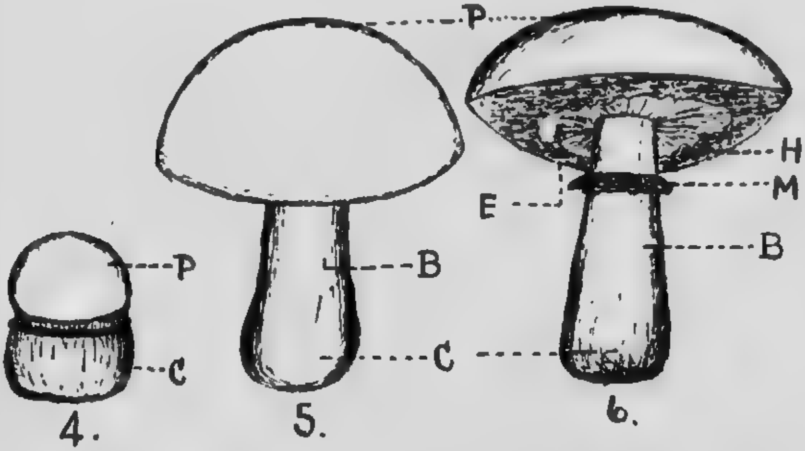
(Refer to *Mushrooms*, Atkinson.)



15. Poisonous species of mushroom. 1. Immature form; 2, form nearly mature; 3, mature individual, volva, or cup; E. gills; P. pileus, or cap, with remains of volva on the surface; A. ring; B. stalk.

EXERCISE 10:

A part of one afternoon in October should be devoted by the whole school to searching for mushrooms. The specimens may be brought to the class-room and classified as indicated above. A beautiful spore-print, showing clearly the colour of the spores, may be obtained by placing the cap of the mushroom, gills down, on a paper, white or dark-coloured, depending on the colour expected, covering it with an inverted bowl, dish, or hat, and leaving it for a few hours.



16. Common mushroom, edible. 4, Young individual in the "button" stage; 5, nearly mature; 6, mature form, M. ring; E. gills; B. stalk; C. rounded base of stalk; H. remains of ring still attached to pileus, or cap. No volva persisting either on the top of the cap or at the base.

EXERCISE 11:

Bulbs.—Secure from the dealer bulbs of hyacinths and tulips, perhaps also of narcissi and jonquils. Point out to the pupils that the food supply, upon which the plant draws to produce flowers, is stored up in the bulbs. These bulbs perform a function similar to that of onions. It will thus be seen that fertile soil is not necessary, and that moist sand or gravel, or even water, if repeatedly changed, may be used instead of soil.

Hyacinths and narcissi are especial favourites for house plants. They should be started in the autumn in jars containing moist gravel or coarse sand, or in pots with sandy, loose soil.

Bulbs should be planted in the autumn (October or November) in the ground for spring bloom. There should be a bed of bulbs in every school ground. Have the pupils plant them about three inches deep in a prepared bed, which should be covered over with leaves, straw, or other litter, during the winter. This litter provides a covering suitable to the needs of the bulbs and should be raked off in early spring.

The pupils should be encouraged to take some of the bulbs home to develop as home projects. (Read the Section on Home Projects, page 141.)

NOVEMBER

EXERCISE 1:

Request the pupils to make a list of the agricultural products of the district. Which of these are consumed at home? Where are the markets for, and what are the prices of, potatoes, apples, butter, cheese, eggs, wheat, oats, barley, and rye?

EXERCISE 2:

Have one of the pupils bring a moulting hen to the class. Study the development of the new feathers and compare with the old ones. Point out the uses of moulting to the bird. Is it a preparation for the breeding season or for winter? Do other animals (mammals) moult (lose their hair)? (*Ontario Agricultural College Bulletin, 247*)

EXERCISE 3:

Secure leg bands for chickens, and some equipment for poultry-keeping, such as feeding boxes, watering trough, trap nests, etc. Let the pupils handle these, and discuss with them their uses.

EXERCISE 4:

Show the importance of dust to the animal in keeping itself free from vermin. How does dust affect insects? Lime, sifted coal-ashes, and road dust are especially serviceable.

EXERCISE 5:

Take the class to a neighbouring orchard and observe a tree that has been pruned, or have a tree pruned by some one who understands the principles involved. Explain "dehorning" as applied to pruning. (See illustrations and refer to Exercise 6, October, page 29, and *Ontario Agricultural College Bulletin, 248.*)

EXERCISE 6:

Discuss the importance of pruning and caring for an orchard. Ask the pupils to refer to their notes on Exercise 6, for October, page 29. Give a review on pruning.

EXERCISE 7:

Give a lesson on the origin of the utility breeds of hens, and the characteristics of the Asiatic and of the Mediterranean breeds. The Cochin is a type of the Asiatic breeds; the Plymouth Rock of the utility, or American breeds; and the Leghorn of the Mediterranean breeds.

EXERCISE 8:

Give a lesson on seed selection: Secure a few pounds of some variety of grain—oats, for example. Distribute an ounce or two to each pupil and ask them to select one hundred or so of the best seeds, and preserve these in an envelope for planting in the following spring. In the spring the *selected* seeds and the *average* seeds should be planted side by side, for an experiment in the school garden.

EXERCISE 9:

Refer to page 42, *et seq.*, and to *Types and Breeds of Farm Animals*, Plumb. Give the origin and a brief history of the Shorthorn, the Hereford, the Galloway, and the Aberdeen Angus. What is meant by Baby Beef? If possible, invite some farmer to contribute a lesson or two. If he will not come to the school, take the pupils to his farmyard. (See illustrations of types of beef cattle and refer to pages dealing with this topic.)

EXERCISE 10:

Give a lesson on the dairy breeds, and give some description of those which may be common in the locality —Ayrshire, Jersey, Holstein, Dairy Shorthorn, or Guernsey. Secure from the pupils a list of all the breeds in the locality. Point out the chief advantages of the use of pure-bred stock, whether of the beef type or of the dairy type. (See Figures 34-39.)

GRADE CATTLE

Many cattle in Ontario are not *pure bred.* In order to secure an animal capable of registration for a pedigree, a certain number of crosses with a pure-bred animal are necessary. For some breeds of animals five crosses are required, consequently a second, third, or fourth cross results in improvement, the fourth being a grade better than the third, and the third a grade better than the second. Such stock is considered *grade* stock. If the process of grading up be continued a sufficient number of generations, which are usually determined by the Breeders' Associations, a pure-bred, or pedigreed, animal qualified for registration in the Herd Book is the result. A mongrel is not a grade animal.

WINTER WORK OF FIRST YEAR

December

FARM ARITHMETIC

SCHOOL GARDEN ARITHMETIC

Figures taken preferably from the pupils' own school gardens

1. A garden 150′ x 50′ is divided into four equal parts by a path 4′ wide running lengthwise down the middle and another path 2′ wide running crosswise through the middle.
   (*a*) Draw a plan of the garden showing the paths.
   (*b*) Find the area in square ft., and in the nearest simple fraction of an acre. (If there is a school garden, have the pupils measure it.)
2. (*a*) Find the length of the two paths in (1) above in inches.
   (*b*) Find their area in square inches.
   (*c*) Find what fraction the area of the paths is of the total area.
3. A plot 6½ ft. wide and 20 ft. long is planted with onions in rows 12 inches apart.

(*a*) If the rows at the sides of the plot are 6 in. in from the edge, find the number of rows. Make a drawing to scale.

(*b*) If ½ oz. of seed sows 100 ft., what weight of seed is required for the plot?

(*c*) If each row averages 60 onions weighing 9 oz. each, find the value of the onions at $2.00 per bu.

4. (*a*) Find the cost of seed potatoes at $3.75 a bag (1½ bu.) required to plant a plot 40 ft. x 36 ft. in rows running lengthwise 2 ft apart and the side rows 1 ft. from the edge, if the "sets" weigh 1½ oz. each and are planted 1 ft. apart.

(*b*) At this rate what would it cost for "seed" to plant an acre of potatoes?

(*c*) If the total yield of the plot is 8 bags, how many bu. is this per acre? (*Ontario Agricultural College Bulletin, 239*)

PLANS OR MAPS OF FARMS

5. A 100-acre farm, 200 x 80 rods, is divided into 10-acre fields with a 33-foot lane running lengthwise. Make a diagram, to scale, of the farm. If the lane and fields are fenced with fences occupying a strip 7 feet wide, how much land is occupied by lane and fences? Assume that all line fences and road fences are half on the property.

6. (*a*) Make a diagram to show a good arrangement of a 100-acre farm, 160 rods x 100 rods, with a lane in the middle running lengthwise to a

road. This problem should be given for consultation with parents at home, so as to show a suitable arrangement of orchard, house, barn, and water supply.

(*b*) Divide the farm mentioned in (*a*) above into four 20-acre fields, with a view to a 4-year rotation, the remainder being used for other purposes.

NOTE.—In Ontario a good three-year rotation is—hoed crop (turnips, mangels, corn, etc.), oats (seeded down with clover), then clover hay; then hoed crop, oats, clover, and so on. Another, similar to the above, with timothy seeded along with the clover will give a four-year rotation—hoed crop, oats, clover, timothy, etc.—a good rotation for a stock farm which has some permanent pasture. The barnyard manure is applied just before the hoed crop. If more grain is required, it will be necessary to modify this rotation, and commercial fertilizers will probably then be required.

7. From data obtained at home or from the following, calculate the net profit per acre of growing oats. The figures are taken from a 10-acre field with land worth $75.00 an acre and interest at 5%.

Ploughing	$31.75	Binder twine	1.80
Harrowing	3.00	Thrashing	11.00
Sowing with seed drill	4.00	Marketing	8.15
Rolling	1.50	Share in fertilizers	11.25
Disking or cultivating	8.00	Seed, 7 pks. per acre, at 90c. a bushel	....
Harvesting	8.50	(Calculate)	

The yield was 580 bushels, which sold at 63c. per bushel.

8. ICEHOUSE AND DAIRYING

NOTE.—1 cu. ft. of ice weighs 57 lb.
1 ton occupies 35 cu. ft. (nearly).
Size of cake 22 x 22 x 10 inches.

(*a*) How many cakes of ice to a ton?

(*b*) An icehouse is 10 ft. square and 10 ft. high to the plate. If the gables are left open, how much inch lumber would it take to wall in the sides?

(*c*) How many cu. ft. of ice will it hold, if there is a space of 2 ft. above, below, and at the sides for shavings or sawdust?

(*d*) How many square feet of ice are required from the pond?

(*e*) A man has a dairy herd of 20 cows. If it requires 1½ tons of ice to cool the milk of one cow, how many cu. ft. of ice would be required to cool the milk of the herd? (*Ontario Agricultural College Bulletin, 207*)

9. Ascertain from the pupils the amount of milk obtained from a cow at a milking and from this calculate:

(*a*) The amount in one month.

(*b*) The amount in eight months.

If a cow gave an average of 9 quarts of milk at a milking (night and morning), what would be the total value of the milk at 6c. a quart

(i) In the month of May?

(ii) From April 15th to October 15th inclusive?

GENERAL

10. Three hogs from the age of 6 weeks to 22 weeks consume:

641	lb.	middlings at	1.25	cents	per	pound
56	"	rye meal at	1.4	"	"	"
12	"	oil cake at	1.4	"	"	"
5	"	small potatoes at ..	.5	"	"	"
10	"	oat chop at	1.25	"	"	"
40	"	shorts at	1.25	"	"	"
90	"	low grade chop at..	1.6	"	"	"
130	"	skim milk at	.25	"	"	"
2,515	"	whey at	.15	"	"	"

They were sold when the total weight was 612 lb. at 11½c. Disregarding the cost previous to the age of 6 weeks and the cost of care, find the gain.

11. One boy hires out on April 18th at $15.00 a month and board, and another hires out the same day at $7.00 a week without board. If the second boy pays $4.00 a week for board, compare the net earnings of the two boys on October 1st.

12. A boy drives the cows night and morning, from May 10th to September 10th, to and from the pasture-field, which is 900 yards from the barn. How far in miles has he walked?

BREEDS OF FARM ANIMALS

(The following should be read carefully by the teacher before he undertakes to teach this topic.)

HORSES

From time immemorial the horse has been associated with man and has performed for him a variety of services which naturally fall under two headings—draught and speed. Such services require, for the best results, certain types of size and build in the animal, which are known as Draught and Light.

17. Shetland pony

Draught Horses: The breeds of horses which have been developed especially for drawing heavy loads are given different names, not merely because they differ somewhat in form, but rather because they have been developed in different places, though with the same general aim in view. The breeds are the Clydesdale, Percheron, Belgian, Shire, and Suffolk Punch. (See Figures 18-21.)

Clyde.—The Clydesdale, as its name implies, was developed in Scotland. The colour is generally bay, varying from a very light fawn to a dark brown, but always with one or more white feet, and generally a white face. It resembles the Shire very closely, but differs mainly in the quality of its legs. Though a first-class draught horse, it is especially noted for its action—that is, its activity on its feet. Both Clyde and Shire have hairy legs.

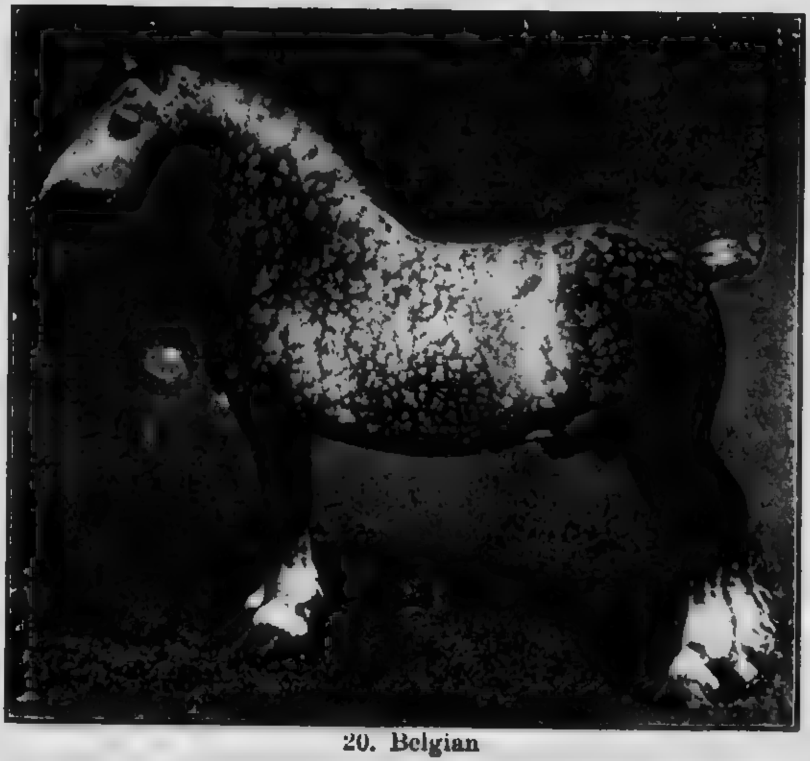
18. Clydesdale

Percheron.—For many years this type has been much in favour in France, and is generally either gray or black, never bay or sorrel. The legs are devoid of long hair. This breed is very much favoured by horsemen in many parts of Canada and the United States.

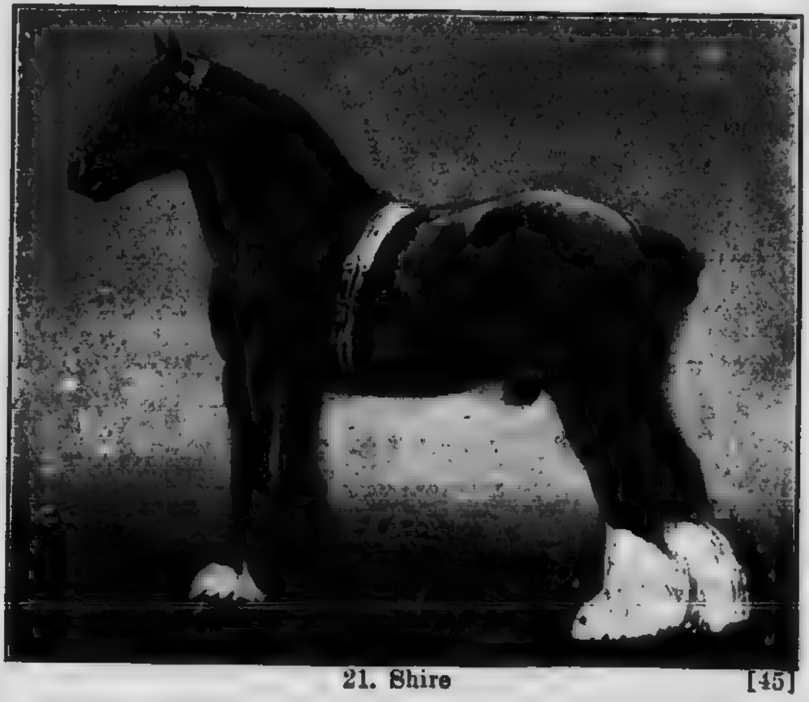
19. Percheron

Belgian.—As the name indicates, this is a breed which has been developed in Belgium. It has a very "chunky" body and is generally of a sorrel colour. It has neither the beauty of the Percheron nor the action of the Clyde.

Shire.—This breed resembles the Clyde in colour and in form, but it requires an expert to distinguish the two breeds. The differences are rather in the ideals of the



20. Belgian



21. Shire

breeder—the Shire breeder aiming at a good, round, muscular body, while the Clydesdale breeder aims to produce, in addition to a muscular body, an active animal.

Suffolk Punch.—This is generally of a sorrel chestnut colour with or without a white face, and has much less hair on its legs than either the Clyde or the Shire. As its name might imply, it was developed in England. It is a good draught horse, of a quiet disposition, but, with some exceptions, has not been popular in Ontario.

22. Suffolk Punch

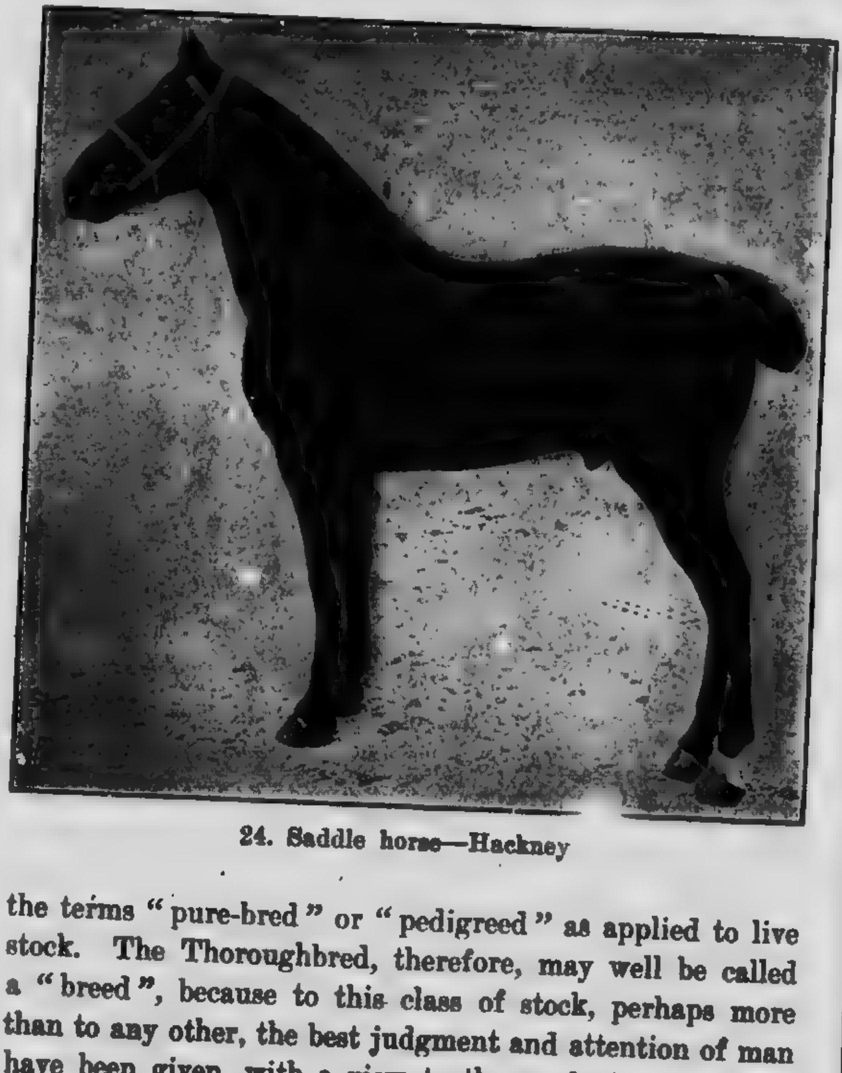
Light Horses: The breeds developed for speed have a wider variety of names, but none of them derived from names of localities, as in the case of the draught horses.

These breeds may be divided roughly into two classes—Saddle horses and Harness horses. The former class includes race-horses and hackneys; the latter, roadsters, trotting horses, pacers, and carriage horses. The trotting horses include the standard-bred class, which means a class having a speed record of not less than 2.30, that is, a mile in two minutes and thirty seconds.

23. Roadster

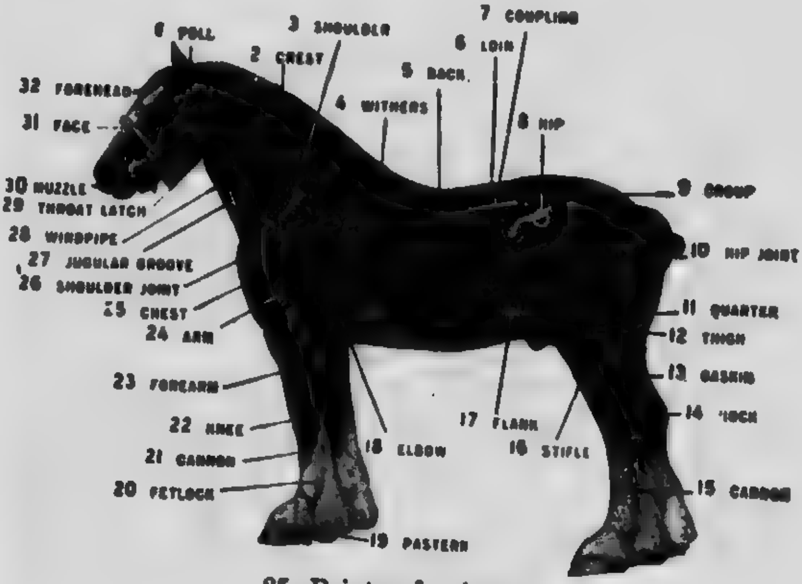
The colours of these breeds are not so distinctive as is the case with draught horses, consequently it is not easy to classify them in regard to colour. The size and build also vary considerably.

Thoroughbred.—This is a name applied to the English running race-horse, and should not be confused with the terms "pure-bred" or "pedigreed" as applied to live stock. The Thoroughbred, therefore, may well be called a "breed", because to this class of stock, perhaps more than to any other, the best judgment and attention of man have been given, with a view to the producing of a type



24. Saddle horse—Hackney

of animal whose strain of ancestry has been kept pure. Owing to the fact that the blood strain has been kept pure for a long line of generations, the term "Blood Horse" has been applied. It is reasonably certain that this breed can claim as its ancestors the Arab horse, noted in mythology and in history.



25. Points of a horse

GENERAL PURPOSE HORSE

This is a type which is useful for general farm work. They are of medium size as compared with the Clyde and the Roadster, and are not generally regarded as a special breed; but because of the great variety of uses to which they may be put—for farming, for delivery wagons, etc.—they are of great importance in this Province. (Refer to *Types and Breeds of Farm Animals,* Plumb.)

CATTLE

The two chief uses of cattle are so distinct that the breeds, more definitely than is the case with other domestic animals, fall readily into two fairly well-defined classes—the Beef type and the Dairy type.

Beef Breeds: Representative breeds of the beef type in Ontario are the Durhams (both Shorthorn and Polled), the Herefords, the Aberdeen Angus (Polled Angus), and the Galloways. The two breeds first mentioned were developed in England, and the other two in Scotland.

26. Shorthorn bull—beef type

Shorthorn.—The most popular beef breed in Ontario is the Shorthorn. The usual colour is roan, but occasionally one individual is all red and another all white. The Polled Durham (hornless) is similar in type and colour to the Shorthorn. It originated probably in Durham County, England.

27. Shorthorn heifer

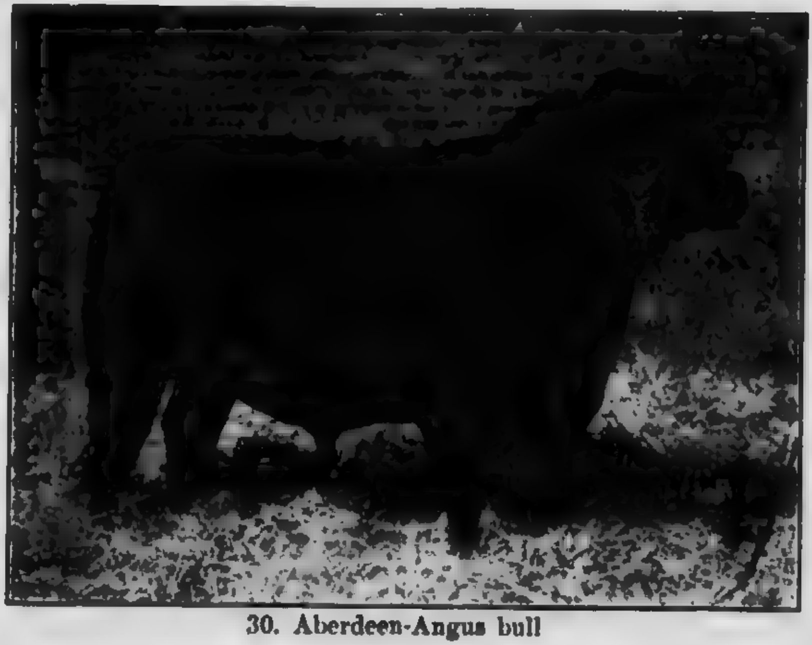
28. Polled Durham

Hereford.—This breed is popular in the West. It has a white head and white feet with body dark reddish-brown. The horns are quite long and spreading. A polled (hornless) type has recently been developed. The breed is said to have had its origin in Hereford County, England.

Aberdeen Angus.—These animals are without horns and are of a coal-black colour. They are rapidly becoming popular in Ontario, having been introduced from Scotland. Of all the beef breeds this is perhaps the poorest for dairy purposes.

29. Hereford bull

Galloway.—This breed has not been very popular in Ontario. It resembles the Aberdeen Angus very closely, and no doubt both breeds come from a common ancestry. It is a hardy breed and has found some favour in the West. It is of very little use for dairy purposes.



30. Aberdeen-Angus bull

31. Aberdeen-Angus cow and calf

32. Galloway bull

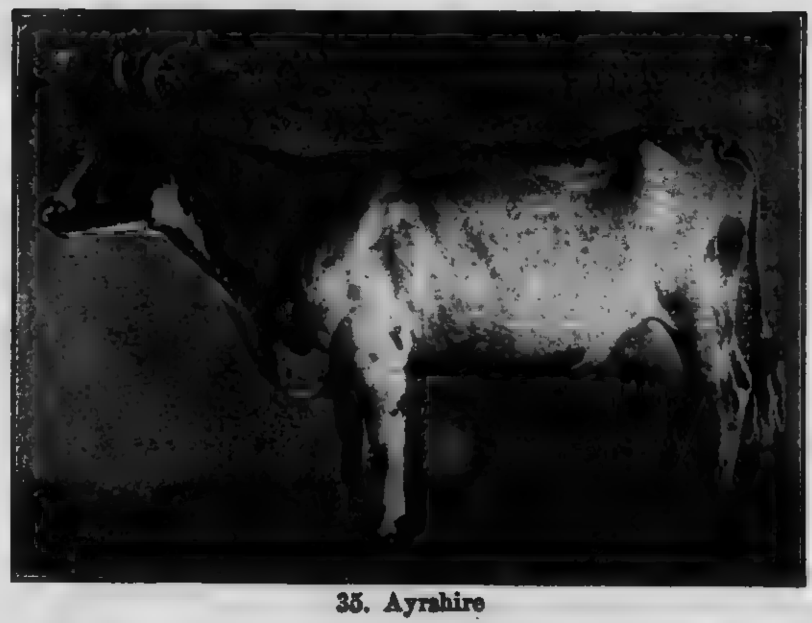
33. Baby beef (from one year to two years old)

Dairy Breeds: The most important dairy breeds in Ontario are—Holstein, Ayrshire, Jersey, Dairy Shorthorn, and Guernsey. All the dairy breeds have horns.

Holstein.—The individuals are spotted black and white; some are nearly all white, and others nearly all black, but the black and white hairs are never mixed. The breed originated in Northern Europe, and is becoming very popular in Ontario, chiefly because of the large amount of milk produced.

34. Holstein

Ayrshire.—This breed was developed in Scotland and is probably the hardiest of the dairy breeds. The individuals are spotted red and white, some being nearly all white and others nearly all red. The red and white are never mixed, as is the case with the Shorthorn.



35. Ayrshire

36. Jersey

Jersey.—This very popular breed is quite common in Ontario, especially where only one or two cows are kept. The milk is very rich in milk fat, and the flow is fairly large in proportion to the size of the cow. It had its origin in the Island of the same name.

Dairy Shorthorn.—The Shorthorn Durham, though a beef type, may, in favourable conditions, produce a good flow of milk. This breed approaches nearest to what might be called the general purpose (dual purpose) breed. Some strains of this breed have been developed as dairy cows, while at the same time retaining the beef-producing quality. The Dairy Shorthorn has, in a general way, the colour and form characteristics of the Beef Shorthorn.

37. Dairy Shorthorn

Guernsey.—This breed, though not common in Ontario, is one of the very best dairy breeds. It had its origin in

38. Guernsey cow

39. Guernsey bull

the Channel Islands, and is being introduced rapidly into several parts of the United States. It is spotted fawn and white, and is considerably larger than the Jersey.

Which is the best dairy breed is not easy to say. Each has its champions. Whether it is more profitable to keep one rather than another will depend upon the special purpose for which it is kept. In the case of the typical dairy breeds, the calves which are not to be used for dairy purposes are not of much value, nor is the cow herself of much value as beef when her milking days are over. These matters are of serious importance when the farmer has to decide what breed is the most profitable for him to keep.

PIGS

The pig as a domestic animal is used wholly to supply meat for human food. From this it might appear that there could be but one class of such animals. However, owing to the fact that certain types of animals contribute in an especial manner toward the production of certain types of pork, two classes have been recognized—the Fat Pig and the Bacon Pig. As will be seen at a glance, there is no very marked line of distinction. (See illustrations.)

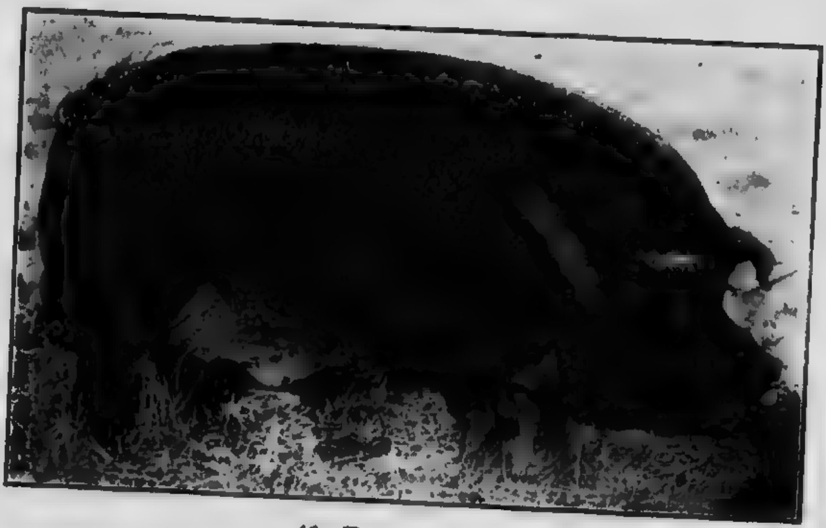
FAT-PIG BREEDS: The Fat-pig type is well represented by the Poland China, the Duroc Jersey, the Chester White, and certain types of Berkshire.

Poland China.—The original home of the Poland China is probably in the eastern end of the Corn Belt of the United States, in the State of Ohio. This breed is black, with white feet, a white spot on the face, and a white tip on the tail. These markings are practically those of the Berkshire, but these two breeds can be easily distinguished by the ears, which flop over toward the nose of the Poland China, and stand somewhat erect in the Berkshire.

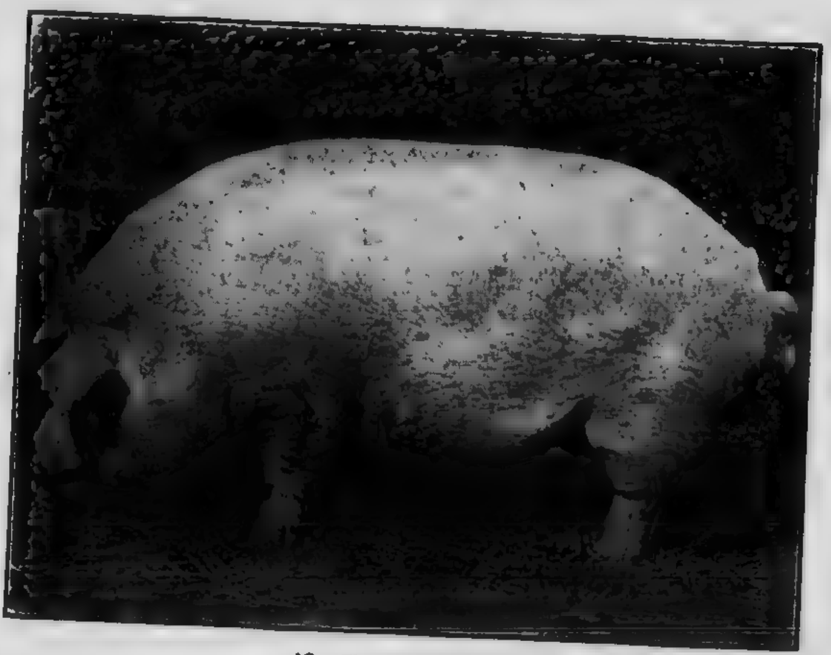
Duroc Jersey.—This breed originated from two sources, the Duroc in New York State, and the Jersey in the State of New Jersey. The Duroc Jersey is a typical fat pig which has been developed in the Corn Belt. It has reddish hair and black skin with no white whatever. The only other breed in Ontario of a reddish colour is the Tamworth, which is readily distinguished from the Duroc Jersey by the flopping ears of the latter.

40. Poland China

Chester White.—This breed has white hair and skin, and the ear characteristics are similar to those of the Duroc Jersey.



41. Duroc Jersey



42. Chester White

Berkshire.—The small-breed Berkshire is very common in certain parts of Ontario and very popular as a fat pig. Its colour and markings are similar to those of the Poland China.

BACON-PIG BREEDS: The Bacon type of pig is that found particularly in the Tamworth and the large breed Yorkshire.

43. Berkshire

Tamworth.—This breed is of English origin and is doubtless connected in some way with the "razor back" pig which it resembles. It has reddish hair on a dark flesh-coloured (not black) skin. The body is long, snout long and straight, and legs relatively long.

Yorkshire.—The Yorkshire has white hair and skin and large, long body. As the production of bacon for export to the British markets has developed, these two breeds have forged ahead rapidly in Ontario during the past ten or fifteen years.

44. Tamworth

45. Yorkshire

Berkshire.—The large breed Berkshire is considered a fair bacon hog, and has long been a great favourite in Ontario. Both Berkshire and Yorkshire are of English origin.

The illustrations represent typical specimens of the breeds named. (Refer to *Swine Husbandry*, Day.)

46. Collie (sheep dog)

SHEEP

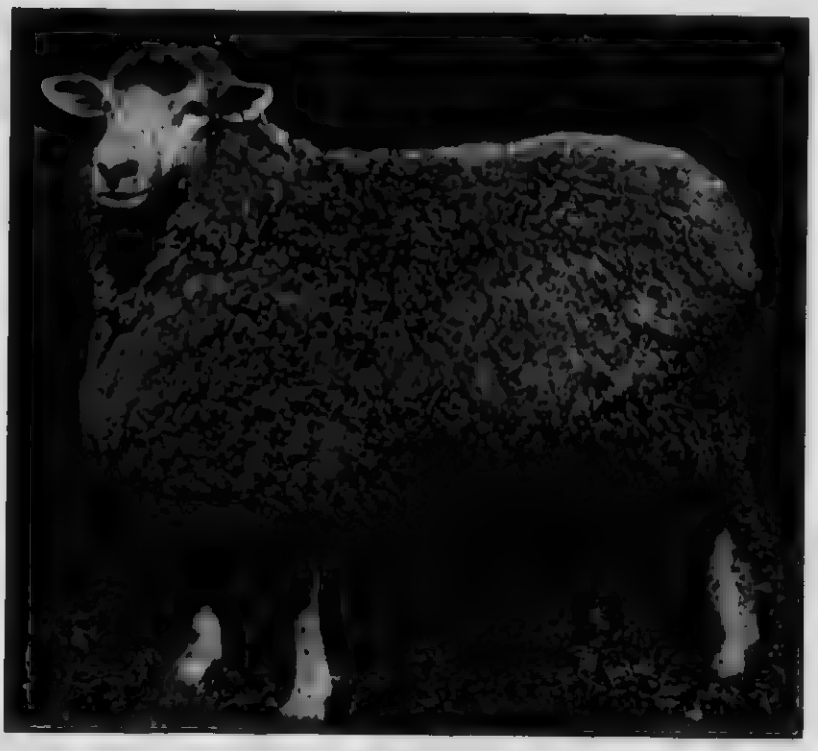
Of all the domesticated animals, the sheep appears to have been associated with the human race the longest. Although so widely known and of such general use, the management of the sheep is less understood than is the management of horses, cattle, or pigs. The first use to which sheep were put was to supply food, the use of wool for clothing coming later. They are usually classed in groups, or breeds, largely according to the character of the wool which they produce, into Long-woolled, Medium-woolled, and Fine-woolled classes. Representatives of the Long-woolled types are the Cotswold, Leicester, and Lincoln. The Medium-woolled breeds include Southdown, Oxford Down, Shropshire Down, and Hampshire Down; and the Fine-woolled include the Merino and the Rambouillet (pronounced *Ram'boo-yay*).

46a. Cotswold

Long-woolled Breeds:

Cotswolds.—As the name implies, this breed originated in the Cotswold Hills in Gloucester, England. It is one of the most beautiful of sheep, with long curly fleece, symmetrical form, and long curly forelock.

Lincolns.—These sheep resemble the Cotswold closely, but are larger in body. They are, perhaps, the largest breed known. The wool is very long and coarse, but has a very lustrous appearance. This breed originated probably in Lincolnshire.



47. Lincoln

Leicesters.—This breed gets its name from Leicestershire, where it is supposed to have originated. It is a good type of sheep and fairly common in Ontario. It differs from the Lincoln and the Cotswold mainly in the absence of a forelock. The wool is long but fairly fine.

MEDIUM-WOOLLED BREEDS:

Southdowns.—This breed is the smallest of the Medium-woolled sheep. It is very round and compact in form, producing especially desirable mutton. Its face is gray. The wool is fine and rather short.

48. Leicester

Oxford Down.—These sheep resemble the Southdown, but they are larger and have longer and coarser wool. They are quite common in Ontario.

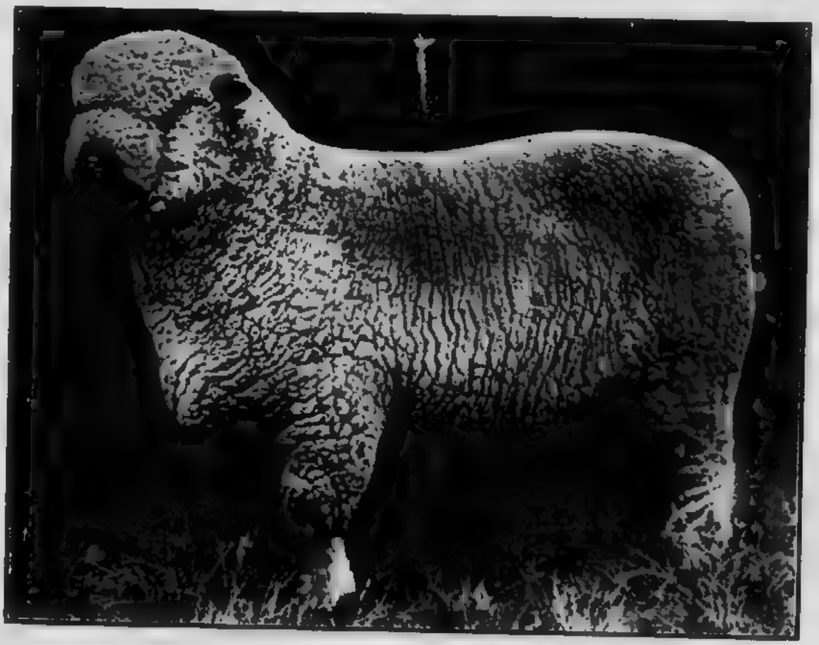
49. Southdown

Courtesy of Henry Arkell, Arkell, Ont.

50. Oxford Down

Shropshire Down.—Of all the black-faced breeds this is the commonest in Ontario. It resembles both Southdown and Oxford Down, but may easily be distinguished from both by the fact that the face is nearly covered with wool.

Hampshire Down.—This breed is not yet very common in Ontario. It resembles the Oxford Down most closely, but may be distinguished by its blacker face and smaller body.



51. Shropshire Down

The Medium-woolled breeds named above are all black-faced or gray-faced, the colour of the hair on the face varying from gray (in Southdown) to black. They are somewhat related as a group. There is a probability that the ancestry of the black-faced classes lies in the so-called black sheep not uncommon here and there among the older native sheep.

Fine-woolled Breeds:

Merinos.—This breed has its origin in Spain, and is now the most cosmopolitan of all breeds. It is a rather small type of sheep, with short, fine wool and very wrinkled skin. This is one of the horned breeds (only the male has horns).

52. Hampshire

Rambouillet.—This is a breed developed near Paris in France from stock obtained from Merino breeders in Spain by the selection and careful breeding of a larger and stronger type than the Merino. This process of development has been carried on in both France and Germany, and from the flocks so developed the stock in America has been produced. Like the Merino it is a horned sheep. Neither the Merino nor the Rambouillet is common in Ontario. The Rambouillet in America has been called the Delaine Merino.

53. Merino

54. Rambouillet

Sheep-raising in Ontario is not carried on to such an extent as might be expected, in view of the profit to be derived. Sheep do not thrive well on low-lying or damp land, but seem well adapted to hills and uplands. The destruction of sheep by dogs has no doubt prevented many farmers from keeping a flock. Sheep require less care and attention in proportion to the value of the flock than any other live stock.

POULTRY

In Elementary Agriculture the study of Poultry resolves itself almost wholly into a study of the species known under the common name of hens (or chickens). Geese, ducks, turkeys, etc., are also included under the same heading, but because of the great importance of the hen in comparison with these species, the mention of the latter is omitted here.

The domestic hen can be traced to two different geographical sources—Asia and Europe. Some of the present representatives of the Asiatic breeds are—Cochins, Brahmas, and Langshans; and of the European—Leghorns, Minorcas, Black Spanish, and Hamburgs.

ASIATIC BREEDS

Their characteristics are feathered legs, brownish eggs, heavy bodies, small combs and wattles, and red ear-lobes. These breeds are desirable for meat production, but are not generally considered the best layers; though, of course, some strains show very creditable results in egg production. As their bodies are heavy, they cannot fly to any great extent, and, consequently, are easy to keep within bounds by a relatively low poultry netting. Being larger birds, they require considerably more food than the European breeds.

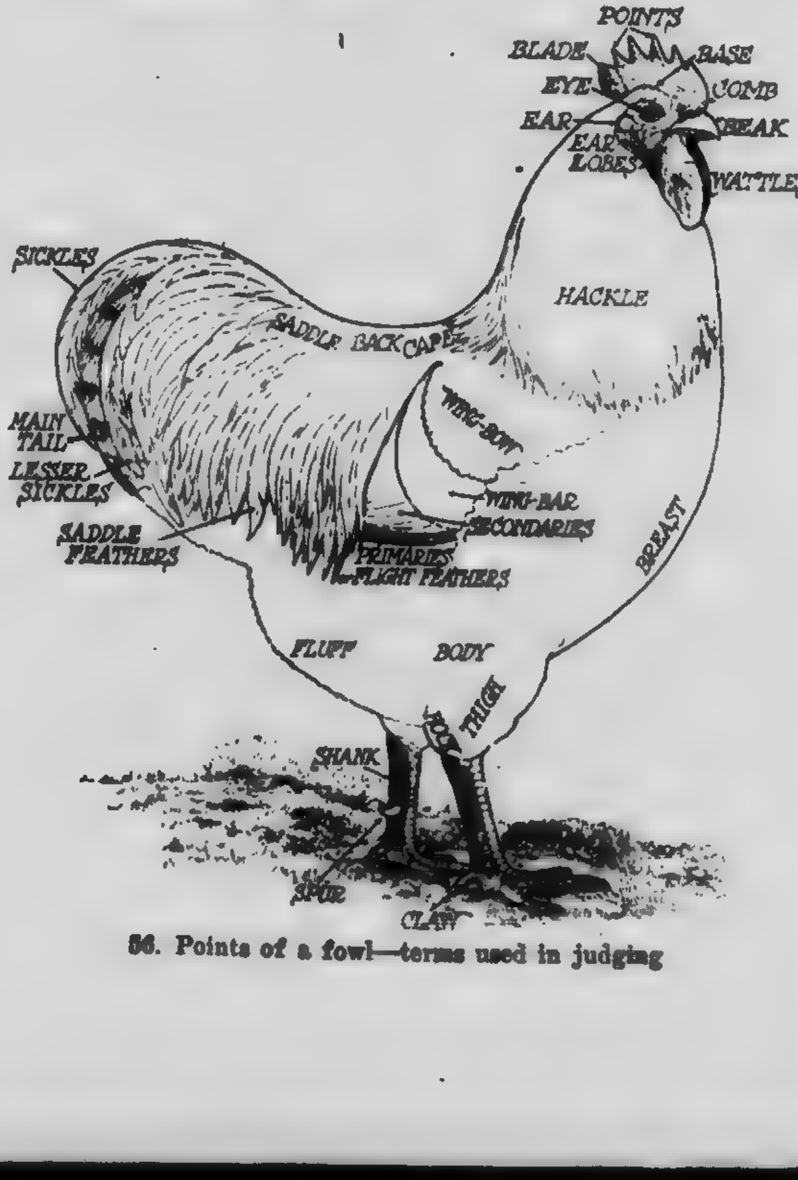
Courtesy of T. A. Faulds, London, Ont.

55. Minorca (type of European breed)

55a. Langshan (type of Asiatic breed)

EUROPEAN BREEDS

These are characterized as follows—no feathers on the legs, white eggs, large combs and wattles, and generally white ear-lobes. They are not inclined to be broody. These breeds are particularly desirable as egg-producers, but, because of their relatively small bodies, are not so valuable for meat production. They have strong wings and can fly readily; consequently, it is more difficult to keep them within the poultry yard.



56. Points of a fowl—terms used in judging

GENERAL PURPOSE BREEDS

Both considerations—egg production and meat production—are very important from an economic point of view in any breed of poultry; consequently, through long processes of breeding, other types combining the two desirable characteristics have been developed. These breeds have been called Utility breeds, and sometimes General Purpose breeds. Those developed in the United States are Plymouth Rocks, Wyandottes, and Rhode Island Reds; in England, the Orpington, the Sussex, and the Dorking.

57. Single Comb Rhode Island Red

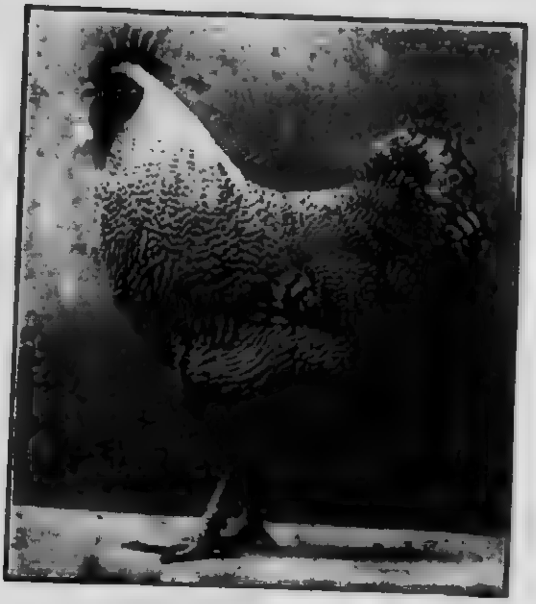
The commonest breeds of all in Ontario are the Plymouth Rocks, but the Wyandottes and Rhode Island Reds are forging ahead rapidly. Of the European breeds the Leghorn and the Minorca have found many admirers, especially among those who keep hens chiefly for the eggs they lay. These two breeds find favour, too, among those who dislike broody hens during the summer.

The ancestry of the utility breeds may be traced to both Europe and Asia.

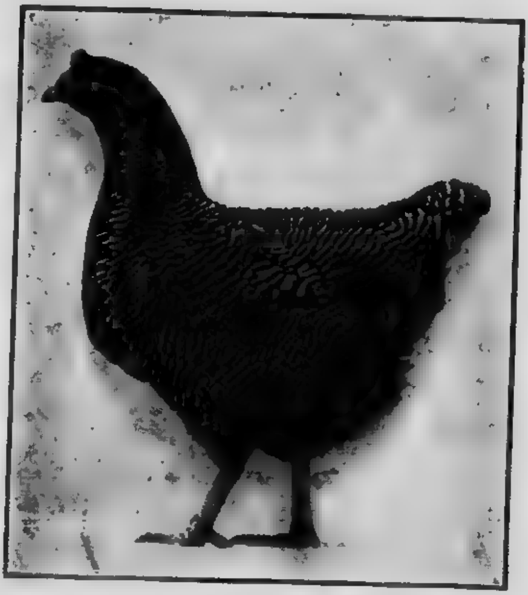
Poultry breeding has been productive of interesting results in various ways. Within the limits of any class—the Plymouth Rocks, for example—there may be a great variety of colour-forms—Barred Rocks, White Rocks, Buff Rocks, etc.

58. White Plymouth Rock

Bantams are very interesting forms which have been bred up as pets. They are especially admired by young people. By long and careful selection of the small, or runted, forms, from either Asiatic or European breeds, distinct types of bantams have been produced.



59. Barred Rock, male



60. Barred Rock, female

JANUARY

EXERCISE 1:

Cattle.—Obtain from the pupils a list of the breeds of cattle which may be found in the School Section. This list will probably contain several breeds, including both the beef type and the dairy type, as well as many mongrels. Point out the advantages to be derived from having purebred stock as compared with mongrel stock. (See Figures 26-39.) Most of the country pupils know one or more of the common breeds, and they will appreciate good pictures of them.

Give some description of the origin of these breeds and correlate this subject with Geography and History.

EXERCISE 2:

Swine.—Deal similarly with swine, pointing out that they also are divided, rather roughly perhaps, into two types, the fat-pig type and the bacon-pig type. Make a list of the breeds which are found in the Section. Both types will probably be represented.

Fat pork is used in shanty life, mines, etc., and therefore its use is not so general as formerly. The bacon type is rapidly increasing, because of the changes in the mode of life of the people, resulting in a change in the character of the food.

The teacher should secure good pictures of the different types and should teach the pupils to recognize them. (See Figures 40-45.)

EXERCISE 3:

Sheep.—If possible take the class to see a good flock of sheep and secure samples of the wool. Have the pupils make a list of the breeds to be found in the School Section. Compare with those given on pages 65-71.

EXERCISE 4:

Horses. Request the pupils to make a list of breeds of horses found in the neighbourhood, and deal with it as with the list of cattle breeds.

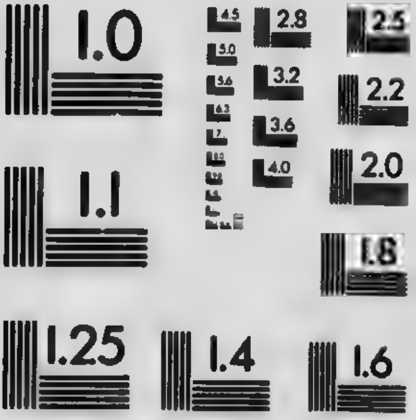
The study of the breeds of animals will add interest to both Geography and History. The Channel Islands become more real when we know that they have given us the Jersey and the Guernsey cattle. Scotland seems less remote when we connect it with the handsome, powerful Clyde, with the Aberdeen Angus, the Ayrshire, and the Galloway. The history of our breeds of farm animals forms a big chapter in the history of our own race, which will be much more readily understood if connections are pointed out. There is no animal so noble as the horse, and what more inspiring than a prancing team of matched horses! Where is the farm boy that does not thrill when he gets hold of the lines behind an eager span? The horse has had much to do with keeping many boys on the farm.

EXERCISE 5:

Select from weed seeds collected in the preceding autumn, five or six different species, and plant them in pots. Have the pupils do this at home, if there is any likelihood of freezing on account of the fires not being kept going during the night or over the week ends. It is an interesting thing to be able to recognize weeds as they come up from the ground. It may be noted here that some of the commonest weed seeds, for example, the Canada thistle and the twitch (couch) grass, do not readily germinate. In the study of weeds in September this lesson should be kept in mind.

MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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EXERCISE 6:

Make a study of seeds of different kinds of weeds, so as to recognize the following—narrow-leaf plantain, black meddick, curled dock, sow-thistle, dandelion. Some of the so-called seeds are really fruits. This is the case in the Composite family, where the pistil contains but one seed. Pistil and seed persist together, and are, therefore, a fruit.

EXERCISE 7:

Ask some of the pupils to secure a pound of soil from the ground near a barnyard, and put this soil in a flat box kept moist and in a warm place, to see if any weeds grow from it. Count the different species.

FEBRUARY

EXERCISE 1:

Ask the pupils to bring twigs of apple-trees and pear-trees to the school for study on the following day. Look for the different markings on the twigs. Note the rings, indicating the presence of a former bud. Compare the buds as to size, shape, and colour. Fruit-buds are usually larger and plumper than the others and contain a cluster of rudimentary flowers. The leaf-buds contain a minute branch which is ready to push out as soon as conditions are favourable. Upon this branch are the undeveloped leaves for the coming year.

EXERCISE 2:

The same branches or branches similar to the above may be used for the study of oyster-shell scale or bark-louse. In some localities the San José scale may be found. Describe the form and appearance of the scale, calling attention to the fact that the male scale is much smaller than the female. (*Ontario Agricultural College Bulletin, 250*)

At this time remedies for scale insects should be indicated and notes made about them. For scale insects the best remedy is the lime-sulphur wash applied in strength of about seven or eight parts of water to one of the commercial stock solution. See Section on Spraying, page 164, and illustrations of scale insects. (Sanderson, *Insect Pests of Farm, Garden, or Orchard*)

EXERCISE 3:

Ask the pupils to bring twigs of plum and cherry to the class. Place these in water and keep in the school if the room is heated by a furnace, and at home if otherwise. These twigs should be left two or three weeks, in order to note the development of both flowers and leaves. There should be some discussion with respect to the food supply, and it should be shown that trees have food stored up for the following year to further the development of flower and leaf. Compare with plants producing bulbs.

EXERCISE 4:

Ask the pupils to bring twigs of currants of any variety to the class-room. These should be examined with respect to markings and structure, and comparisons should be made as to the form, arrangement, and structure of the buds.

EXERCISE 5:

Some of the currant or gooseberry twigs should be set in water to await the development of the buds and, perhaps, of the flowers. In addition, roots may develop near the cut end in the water in two or three weeks. In fact, currants are often rooted in this way before planting. (*Ontario Agricultural College Bulletin, 222*)

EXERCISE 6:

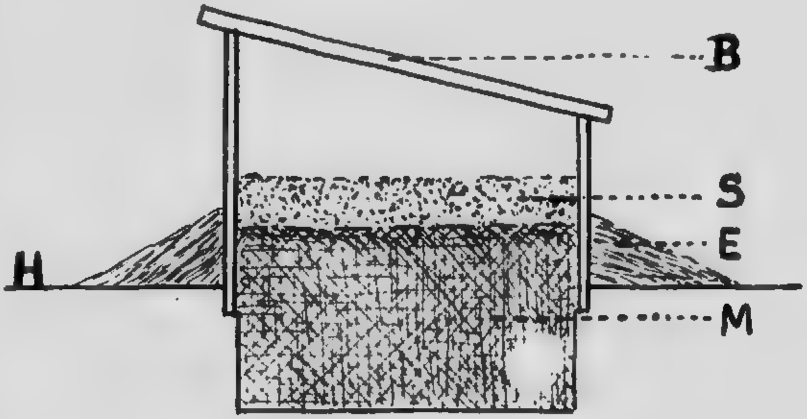
Ask the pupils to secure branches of the wild plum, or pear suckers, and bring them to the class for study. Many of the branches are stunted and are becoming spines. These spines may perform certain functions for the tree. Ask the pupils to suggest these.

EXERCISE 7:

If possible, take the class to an orchard and have the pupils study the trees with a view toward improvement in shape. If a tree be found which needs pruning very badly, a photograph might be taken, before and after, to place in the pupils' note-books. Let each pupil have some share in the pruning and cleaning up; see Figures 13 and 14. (*Essentials of Agriculture,* Waters, page 270)

EXERCISE 8:

There is an erroneous opinion, which is quite general, regarding the scraping of fruit trees. The common notion is that it improves the tree. As a matter of fact, as far as the tree itself is concerned, the scraping is likely to prove injurious. The only advantage in scraping a tree is to remove the pupae of insects which may be concealed in the crevices of the bark. If trees are scraped, care should be taken to see that the scrapings are collected and burned, otherwise it is labour wasted. But frequently the scraping is done in such a way as to remove all of the outer bark and thus lay bare the greenish-yellow inner bark. This should never be done. If the tree is scraped down to the inner bark, it loses water through these scraped areas and thus suffers severely. It should be noted, further, that the outside, or corky, bark is a natural protection against loss of water and against too rapid changes of temperature. This being the case, care should be taken that the tree should not be deprived of this means of protection unless for very strong reasons. Have a portion of a large limb of a tree brought to the class-room, and let the pupils scrape some of the rough bark in order to demonstrate the points mentioned.



61. Hotbed. H, ground level; M, manure; E, banking of manure; S, soil; B, window-sash

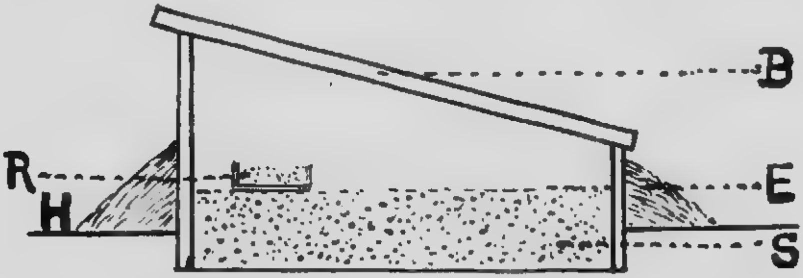
SPRING WORK OF FIRST YEAR

MARCH

EXERCISE 1:

A hotbed at a country school would be not only of great interest, but also of use for home plots, and of [illegible] service to the community. On the south side of the school-house dig an oblong pit 3 feet wide, 6 feet long, and about 4 to 8 inches deep. Board up the back (north side) 18 or 20 inches high, the front about 6 inches less.

and close in the ends. The top would then slope to the south. Now put in a layer of horse manure that has been piled for only a short time, and tramp it down very firmly until it is about nine inches above the surface of the ground. There should now be about 15 inches or so of manure. Then spread 4 to 6 inches of good garden soil on the manure, and the bed is ready. A window-sash, probably a double window, 3 feet by 6 feet, can be laid on by placing cleats around the edges of the top. It would be well to bank up the beds with manure on the outside to the depth of a foot or so. In a few days heat will develop from the decomposition of the manure and keep up for some weeks. Hang a thermometer within and note the temperature three times a day. (See Figure 61.)



62. Cold frame. H, ground level; S, soil; E, banking of manure or straw; B, window-sash; R, flat with plants

Exercise 2:

After the intense heat has subsided (till about 80° or 90° F.) seeds may be sown in the hotbed. It is surprising how many kinds of plants and what a quantity of each may be produced from a bed of this size. Have the class do as much of the work as possible.

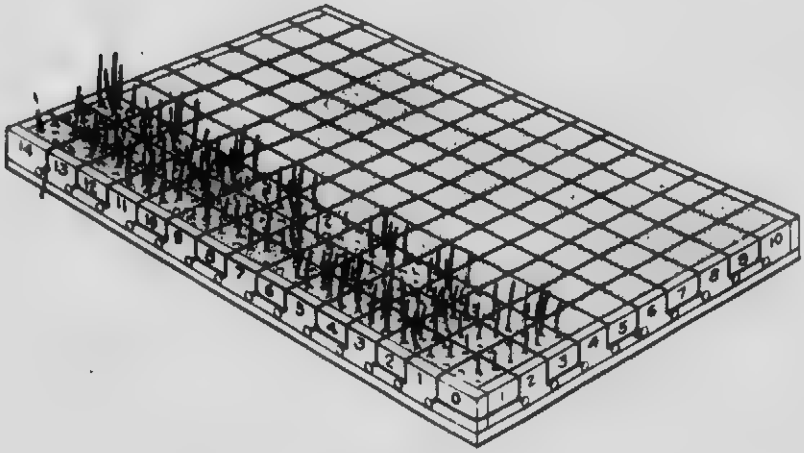
EXERCISE 3:

By keeping the sash down at nights and on cool days, there is little danger of freezing. On hot sunny days the sash should be kept open to prevent over-heating. Sometimes the seeds are sown in boxes or flats, instead of in the soil of the hotbed, as the plants can then be removed and replaced by others with less trouble. If the heat of the manure becomes spent too soon, a fresh supply of manure well banked around the outside will probably tide over the time until this heat is no longer needed. A cold frame is simply a hotbed without the manure, and a good deal can be done in starting plants by using this instead of the hotbed. Encourage pupils to build a cold frame at home or at school.

EXERCISE 4:

Testing seed corn.—From ears which have been preserved from last year's crop select half a dozen kernels from each for the test. Secure a piece of cotton at least 1 yard long and 9 inches wide. Divide into squares two and a half inches wide and number the squares. On each square place six or eight kernels from one ear of corn and number the ear to correspond. All the kernels should point in the same direction. Now roll up carefully so as not to disturb the kernels, and tie a string around to keep the roll tightly in place. Then put the roll into a pail full of warm water and soak over night. Then remove and put into a pail having water only one inch deep. Cover the pail and put in a warm place, perhaps in one corner of the hotbed. Seven or eight rolls might be put into the same pail, as long as it is not over-crowded. In six or eight days the roll may be undone carefully, and the germination noted. The above method is called the "rag doll" method. One objection to this is that as the supply of water to the germinating kernels is due to capillary action, those near the lower end will receive more water than those near the top.

Another good method of testing corn for seed is to secure a flat box 2 feet by 2 feet and fill it with pine sawdust to the depth of two or three inches. Cover this with a cotton cloth marked off into two-inch squares. On these squares should be put the kernels to be tested, six or eight on each square. The kernels should be first soaked in water for one day. When all the kernels are arranged by number, lay a cotton cloth on top, and on top of this put two inches of pine sawdust, which should be kept damp. This should be kept for from five to eight days, when the upper cloth should be carefully rolled back, and the germination noted as weak or strong. Oats, wheat, barley, etc., may be similarly tested. (See Figure 63.)



63. Seed germinator—can be made by the class

PREPARATION FOR SCHOOL GARDEN, ETC.

Preparations for a school garden, securing seed catalogues, and arrangement for special plots should be considered at this time.

Where there is no school garden or where the classes are large, some of the pupils should be encouraged to make window boxes of such a size and form as will be suitable to the windows of the school. These boxes may be undertaken as "home projects". The corners of the boxes should be reinforced with tin straps, and the bottoms bored to permit drainage. Such boxes should be neatly painted.

QUANTITY OF SEED TO SOW PER ACRE

(Refer to *Elementary Agriculture,* Warren, p. 405.)

Alfalfa	15 lb.	Mangels	5 lb.
Barley	7 to 9 pk.	Oats	1¾ to 2½ bu.
Beans	3 pk.	Potatoes (depending on size of "set")	6 to 15 bu.
Beets	5 lb.	Rape, broadcast	4 to 8 lb.
Buckwheat	1 bu.	Rye	1 to 1½ bu.
Clover, alsike	8 lb.	Sugar beets	15 lb.
Clover, red	10 lb.	Timothy	15 to 20 lb.
Corn	5 to 15 lb.	Turnips	3 to 5 lb.
Field peas, small	2 bu.	Wheat	1¼ to 2 bu.
Flax	2 to 3 pk.		
Hungarian millet	2 pk.		

APRIL

COLD FRAMES

The chief use of cold frames is to provide for earlier planting. Many kinds of seed may be sown in boxes in cold frames several days before they could, with safety from danger of frost, be planted in the open. The heat taken in during the day causes a warm atmosphere within the frame, and much of this heat is maintained through the night, even if the temperature without falls below the freezing-point. (See Figure 62.)

Exercise 1:

Secure some early variety of potatoes, either from the parents, or from some of the pupils, or from a dealer, and cut into "sets" with one or two eyes on each, having the pupils actually take part, girls and boys alike. (See Figure 64.) Fill the cold frame up to about 8 inches from the top with good loose soil. It does not need to be rich soil, and it should not be stiff clay. Plant the sets in rows 2½ or 3 inches apart each way and about 2 inches deep, using as much of the space of the cold frame as may

64.—Potato marked for cutting

seem convenient, keeping in mind other things to be planted in this frame. The cold frame should be kept covered with a window-sash except during hot and sunny days, and the soil should be kept only slightly moist. Care must be taken to water only slightly, and yet the soil should not be allowed to dry out. These potatoes will commence to sprout, and in about two weeks they will be ready to set out, that is, to transplant for early planting.

EXERCISE 2:

Have the pupils calculate the length of row these potato "sets" will plant if set out 18 inches apart: and the fraction of an acre they will occupy if planted 18 inches apart in the row and the rows 2½ feet apart. Of course, these plants should not be set out in the open until there is a reasonable prospect that there will be no further frosts, as potatoes are very susceptible to frost.

EXERCISE 3:

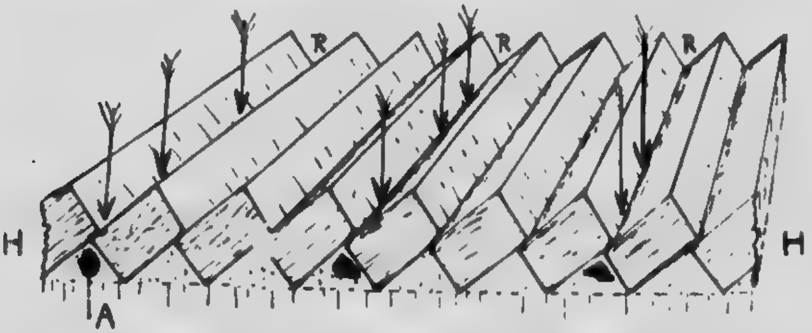
Preparations should be made for the school garden, and all the pupils should have a share in these preparations. If the area is sufficiently large and if the fences and shrubbery are not in the way, it might be found most convenient to plough the garden. If the garden has to be dug, the work should be done by some one sufficiently strong for this heavy labour. Outside of the digging, however, the work should all be undertaken by the pupils. (See Figures 8-11.)

EXERCISE 4:

Each pupil should be asked to prepare on paper a plan of what he expects to work out in the garden. A little diagram should be made to show the plot, the rows of plants, and the distance apart in the row. Some time should be occupied in this phase of the work, because it is of great educational value.

EXERCISE 5:

Give some instruction on the subject of intensive gardening, that is, upon using a small area of land to the best advantage and in the most economical way. Some crops, such as radishes, for example, can be grown in rows between such plants as corn or cabbage, and can be harvested before the corn or cabbage requires the land. In a few cases an early crop, such as early lettuce, can be grown and removed before the land is required for, say, late cauliflowers or potatoes. A good deal of thought should be given to this phase of gardening. Have the pupils calculate in figures, from a supposed case, the advantage of intensive gardening.



65. H.H. represents a vertical section at right angles to the furrow of a portion of a ploughed sod field, and shows the sods lying one against another, with a trough in the surface and a hollow space underneath. As the plough cuts a furrow, say, 11 inches wide, the rows (R.R.) of potatoes will be 33 inches apart. A. represents a "seed" potato in position after planting. The arrows indicate where holes should be made (about 14 inches apart) by forcing a stick like a hoe handle into the ground between the sods, into which hole the seed is dropped.

EXERCISE 6:

If possible, plan out a plot which might be an ideal one for a garden in a city back lot about 16 by 15 feet. In this connection a good deal of planning and thought will be necessary before a decision as to what should be planted is arrived at. After all arrangements are made, the pupils should be asked to keep a complete record of the cost of seed and, later on, of the value of the produce. This can be managed by having a small committee look after this part of the work. When the plants, for example, radishes, are ready for use, have them bunched, counted, and the price given from quotations on the market or from prices obtained from the grocer. When the beans are ready they should be gathered, measured, and the price obtained as for radishes. In this way one of the most useful exercises in account keeping or book-keeping may be practised.

EXERCISE 7:

From the proposition outlined in Exercise 6 a contest might be arranged between two committees, or groups of pupils, either in the school garden or the home garden. These contests produce a good healthy stimulus, and may be made use of in connection with the school fair. Sometimes intensive work is carried on by means of wire frames around the edges of a plot. Cucumbers, or even tomatoes, may be trained to the wire, and thus occupy less of the actual land. All these things are educative and, at the same time, very useful.

EXERCISE 8:

At least one lesson should be given in the school garden on cultivation and on attention to weeds. Stirring the soil assists in retaining moisture for the use of plant roots. Have some of the pupils lay a piece of zinc, a board, or a sheet of oil-cloth, on the cultivated ground for a day or two, then remove, and note the moist condition of the ground under the zinc. A layer of dry earth on top of the soil also prevents a loss of water in the same manner as does the use of the zinc, board, or sheet of oil-cloth.

EXERCISE 9:

Have the class water freely a square yard or two of the garden, and then note that, after the soil becomes dry, there is a sort of crust, or hard layer, on top. This crust will not prevent water from passing out into the air, and it should always be broken up, because the capillary forces are active in passing water up to the surface, with a consequent drying out.

EXERCISE 10:

Intensive gardening.—Plant a row of radishes, then one of spinach, then one of radishes, about 9 inches apart, and, on each side of these three rows, plant one of corn. The corn will then be 36 inches apart. The radishes will be harvested first, then the spinach, and lastly the corn, which will have all the ground to itself during the time when it needs it. This is the commonest form of intensive gardening.

EXERCISE 11:

Early beets may be planted about 16 inches apart, and then, about the first week in June, tomatoes may be planted between the alternate rows of beets, which will put the rows of tomatoes about 32 inches apart. The beets should be harvested in July or August before the tomatoes need all the ground.

EXERCISE 12:

Start seeds of cabbage, tomatoes, and cauliflower, in boxes which are filled nearly full of good, rich, sandy soil. These may be left in the cold frame, but, as the plants are in boxes and not in contact with the ground, they are unable to supply themselves with moisture and must therefore be watered.

EXERCISE 13:

If the school has a machine for treating oats for smut, some neighbouring farmer should be invited to the school to treat a few bags of his seed oats. This can easily be arranged by the teacher, who will provide the formalin. The last half hour of school should be taken for this Exercise, and the farmer might complete his work after the pupils have gone home. (Refer to *Essentials of Agriculture,* Waters, page 293, and *Elements of Agriculture,* Warren, page 254.)

MAY

EXERCISE 1:

Time should be given for work in the garden and for planting the seeds. All arrangements as to plans and kinds of crops should be made previously, so that the maximum of time can be given to the actual work of planting. (See Figures 8-11 and 72-74.)

If the land is to be ploughed, this should be done as early as soil conditions will permit. It is always wise to plan for a space to be left in sod where the horses turn round, so that the part ploughed may not be tramped down. If the land has been ploughed late in the autumn, it is an easy matter to dig it over by hand if the garden is small, or to disk it over if the area is large. Fall ploughing is very desirable, because the frost, air, and snow improve the condition of the soil both physically and chemically.

For Arbor Day improvements and tree-planting see the Section on Beautifying School Grounds (page 152). Discuss with the pupils methods of improvement which might profitably be applied to the grounds of their own school.

EXERCISE 2:

The incubator should be renovated and started with a view to commencing the hatch in a few days. Let the pupils assist in this work. As soon as the temperature can be kept uniformly at about 104° F. the eggs may be put in.

EXERCISE 3:

Ask the pupils to bring eggs to the school, so that each pupil may have some eggs in the hatch. The teacher will find it necessary to make arrangements to give attention to the incubator during two Saturdays and Sundays. If the hatch is commenced on Tuesday, the chickens will commence to chip on the Monday twenty days afterwards. The hatch should be all over on the Thursday following, and the chicks taken away on the next day, Friday. It will be found that the pupils can secure brooding hens at their homes to mother the chicks.

During the process of the hatch, explanation should be made of the need of testing for fertility, turning, cooling, moistening, etc.

EXERCISE 4:

Occasionally an egg should be broken open into a saucer or plate to show the pupils the developing chick.

The attention of the class should be called to the chickens on the twentieth day, as some are likely to be chipping, and it is always an interesting thing for the pupils to see the chick make its way out of the shell.

Caution the pupils against giving the chickens any food for at least forty-eight hours after they leave the shell. The egg yolk is not completely absorbed into the system of the chick when it leaves the shell and, until this is all absorbed, no food should be given, as it is likely to disarrange the digestive system and thus to do harm. One of the very best foods for young chicks is rolled oats.

EXERCISE 5:

To set out an orchard, make a diagram to scale of a field (20 rods long and 10 rods wide) to be planted with apple trees 25 feet apart each way, spacing equally long the ends and sides to suit the size of the field.

EXERCISE 6:

Secure several apple-trees or other fruit trees from the nursery, and have them planted on the school grounds to show the method of planting. (See instructions on Planting Trees, page 153.)

ROADSIDE IMPROVEMENTS

With regard to the improvement of the roadside in front of school property, the teacher should ask the secretary to confer with the township council in order to obtain permission to plant trees or shrubs there. As a rule, the authorities are only too glad to have improvements of this character carried out, but the teacher must recognize that the roadsides are public property under the control of the municipality, and that, for any changes which may be required, permission must be sought.

JUNE

Attention must be given to the gardens.

EXERCISE 1:

Branches of apple, pear, and plum twigs in blossom should be brought to the class by the pupils and studied in comparison, so as to bring out the chief parts—calyx, corolla, stamens, and pistils. Point out the importance of stamens and pistils and the necessity for pollination in the "setting" of fruit.. Teach the pupils to discover the different forms of pistils in the apple, plum, and strawberry.

EXERCISE 2:

Have the pupils demonstrate in the garden the "Campbell Blanket" (dust mulch). The dust mulch prevents loss of water and permits free access of air. (See Exercise 9, April, page 92.)

EXERCISE 3:

Almost fill two lard pails with well-mixed moist loam from the garden. Placé both pails in the sun and weigh each frequently. Stir the surface of one pail to a depth of one inch, and record the weight every twenty-four hours, to discover from which pail the evaporation is more rapid. Vary this experiment by testing the effect of a cut straw or leaf mulch on one pail. Have the pupils draw their own conclusions.

EXERCISE 4:

Secure plants for transplanting from pots, flats, hotbed, or cold frame. In transplanting, care must be taken to see that the roots receive the minimum amount of injury and that they are not allowed to dry out. It is generally wise to have the plants watered at least once after transplanting, if the weather is at all dry.

Arrangements should be made to care for the school gardens during the summer. (See Suggestions for the Teacher, page 10.)

Before closing the school in June, ask the pupils of Form III to collect during the summer small sheaves of wheat, oats, barley, and rye for use in the following January, when comparisons will be made in regard to the heads and the grains. Such sheaves may be kept in the school from year to year if placed beyond the reach of mice.

The teacher should see that all the reference books on Agriculture are distributed among the pupils during the summer vacation and records of them kept for use on the opening of the school in the autumn.

SEASONAL COURSE FOR FORM IV

(Second year of the Course)

AUTUMN WORK OF SECOND YEAR

September

Note.—The books loaned in June should now be returned.

Exercise 1:

Obtain samples of clay, sand or sandy soil, loam, and alluvial soil, the last from a creek bed or from the margin of a small drain. Let the pupils have a sample of each on a saucer. Examine and note the colour, odour, fineness, and general appearance. Feel with the fingers. Soil which is black contains much organic matter. Decaying organic matter is generally called *humus.*

Place about equal amounts of each of these in a tall glass jar (fruit jar), enough to make the jar about one fourth full, and then fill the jar with water. Cover the jar and shake well; then allow it to stand for a day or two. Examine from time to time and note how the soil settles. In a few days examine the soil at the bottom and note how the particles are arranged. Note also that it takes several days for the finest particles to settle. (Refer to *Elements of Agriculture,* Warren, page 105.)

Exercise 2:

Secure some red litmus paper, some blue litmus paper, a little vinegar, and a little soda (washing or baking). Place a little vinegar and water in one saucer and a little of the dissolved soda (dilute) in the other. Touch the litmus paper to each and note the results. Litmus paper is used as a test for acid or alkali. The vinegar is said to be acid and the soda is said to be alkaline. After becoming familiar with this test try blue litmus paper on apple juice, rhubarb juice, baking-powder.

EXERCISE 3:

Let the pupils select samples of soil from different places and use the litmus test to show whether the soils are acid, neutral, or alkaline.

A little of the soil should be stirred up with clean water and allowed to settle for a few minutes. Then test with the litmus paper. Soil to be suitable for crops should be slightly alkaline; at least it should not be acid. As a precaution, the litmus should be as nearly neutral as possible. If a piece of litmus paper is dipped into a strong solution of soda or ammonia and then dipped into a solution which is only slightly acid, the litmus paper may not show acid, because there may be too much of the alkali still clinging to the paper.

EXERCISE 4:

Secure a few samples of commercial fertilizers and test out as with the soil. Obtain a small quantity of slaked lime and test in the same way. Lime is frequently put on the soil so as to make sure that it will not contain acid. It is said thus to neutralize the acidity. Limestone will also neutralize acid, but very slowly. Pulverized limestone is now used as a fertilizer.

EXERCISE 5:

Dip a small pebble into a cup of water and notice the layer of water on the outside. This film, or layer, of water is sometimes called capillary water. Every tiny particle of soil has, ordinarily, a film of water on its surface. Secure three empty tomato cans or corn cans and punch five holes in the bottom. Fill one with sand, another with clay, and the third with rich, dark soil. Place equal amounts by volume in each, and then place the cans in saucers, so that surplus water may be caught as it runs through the soil. Using a measure, put equal amounts of water, carefully measured, into each. Let them stand for some time until drainage ceases, and then measure the water which has drained through and subtract this from the amount poured in, thus ascertaining the amount held by the soil. Equal weights instead of equal volumes may be taken for another experiment.

EXERCISE 6:

Fill one can with sand and another with a mixture, half of dry sand and half of humus. Pour a given amount of water into each, as in (5) above, and measure the amount drained off. How does the humus affect the water-holding power of the soil? If the soil is weighed in these experiments, the proportion by weight might be obtained and also the percentage. Some soil may contain as high as 40% by weight of water.

EXERCISE 7:

Fill a pint jar with clear water from the well or tap and stir thoroughly into it a tablespoonful of clay soil. Let it settle for five or ten minutes; then secure two clean bottles or test-tubes, and pour from the jar enough to fill them, being careful not to stir up the soil. Into one of these bottles or tubes put a piece of lime about the size of a bean, and set aside overnight. Observe the effect of the lime on the soil water. Lime has also an important mechanical effect upon clay soil. By its flocculent influence it tends to make the soil more open and porous. (Refer to *Elements of Agriculture,* Warren, page 127.)

EXERCISE 8:

Rotation of crops.—Ask the pupils to name the crop rotation used in the neighbourhood. This will give rise to some difficulty, because the rotations practised in Ontario are very indefinite. A survey of the neighbourhood in this regard will prove useful, and the best rotation in use should be discussed and emphasized.

EXERCISE 9:

Compare the rotation in practice now with that used forty years ago when much of the land was new. Ask the pupils to consult their parents in this regard.

Point out the importance of crop rotations. (See Section on Fertilizers, page 195.)

Exercise 7, September, page 23, should be repeated for Form IV about this time.

OCTOBER

EXERCISE 1:

Have each of the pupils bring eight or ten potatoes for the lesson on the following day. These potatoes should be all of one variety, if possible, but if not, they should be of one colour. From these potatoes the teacher will select one approximately as near the ideal as possible—with *smooth, shallow eyes, not too long,* etc. This the pupils will proceed to score according to the following:

Trueness of Type—variety characteristics	10
Shape of Tuber—symmetrical and free from depressions or protuberances	10
Size—medium size, 5-8 ounces, (cut 6 points if too large, 9 points if too small)	15
Skin—firm, smooth, and free from sunburn, discoloration, scab, and other blemishes	20
Flesh—solid, small centres, free from worm holes, rot, etc., even in texture, of a clear colour, and free from sogginess or discoloration of any kind	25
Eyes—few in number, strong, but not broad or deep according to variety	20
	100

The shape of the tuber is, of course, determined by the variety of the potato, but it must be symmetrical and of such a form that it will peel easily. It must be free from protuberances and depressions, and of a smooth skin. A potato of medium size is more in demand than a large one, partly because large potatoes are sometimes hollow at the centre. Small potatoes are always objectionable, because they are poor in quality and there is too much loss in peeling them. (*Ontario Agricultural College Bulletin, 230*)

If potatoes appear with the skin broken or "scruffed up", it is an indication that the potatoes are not sufficiently mature. Such tubers are not of first-class quality. When cut the potato should appear free from blemish of any kind, and the more watery it is the poorer is its quality. The eyes should be shallow and relatively few.

In judging potatoes in quantity, uniformity should be considered as about 10%, and in the schedule, 20 for eyes may be reduced to 10.

EXERCISE 2:

These same potatoes may be made use of to show the proper method of cutting the tubers for "seed". In this connection the structure of the tuber should be explained. (See Figure 64.)

EXERCISE 3:

Let the pupils cut off a little from the stem end and stand the tuber on the cut end in a saucer containing a little red dye. After a day or two, cut the tuber across and note the location of the colour. This coloured region is the wood, a very small portion of such a "fleshy" stem.

NOTE.—A bottle of dilute iodine solution, made by dissolving a few crystals of iodine in a solution of potassium iodide in water, should be at hand. Starch is coloured blue by iodine. A little of the pulp of the potato placed on a saucer becomes dark blue when the iodine is added.

EXERCISE 4:

There should be measures and scales for weighing in every school. Potatoes should be weighed by the student so as to determine the weight per bushel. Recent standards are given in the following table:

INSPECTION AND SALE ACT

Description of article	Weight in Dominion standard pounds per bushel
Artichokes	56 lb.
Beans	60 "
Beets	50 "
Blue grass seed	14 "
Carrots	50 "
Castor beans	40 "
Clover seed	60 "
Hemp seed	44 "
Lime	70 "
Malt	36 "
Onions	50 "
Parsnips	45 "
Potatoes	60 "
Timothy seed	48 "
Turnips	50 "

A bag of any article mentioned in this subsection shall contain that number of Dominion standard pounds of such article which is shown in this subsection opposite the name of such article.

Description of article	Weight in Dominion standard pounds per bag
Artichokes	84 lb.
Beets	75 "
Carrots	75 "
Onions	75 "
Parsnips	65 "
Potatoes	90 "
Turnips	75 "

Section 338 of the said Act is repealed, and the following is substituted therefor:

"A barrel of potatoes shall mean, unless a barrel of specified size, kind, or content by measure is specially agreed upon, one hundred and sixty-five Dominion standard pounds of potatoes."

Exercise 6:

Give one lesson on drainage. Ask some of the pupils to bring a tile to school if possible; if not, the teacher will secure a few tiles. Have the pupils examine the structure; then, show them how the tile is laid. (Refer to *Elements of Agriculture*, Warren, pages 106-7.)

Point out the importance of drainage—

(*a*) It enables the farmer to sow his crops earlier and thus to secure a longer season in which to do his work, and also to have a more favourable season for harvesting the crop.

(*b*) Tile-drained soil warms up more quickly, being more thoroughly aerated.

The matter of increased fertility and improved physical conditions should also be emphasized.

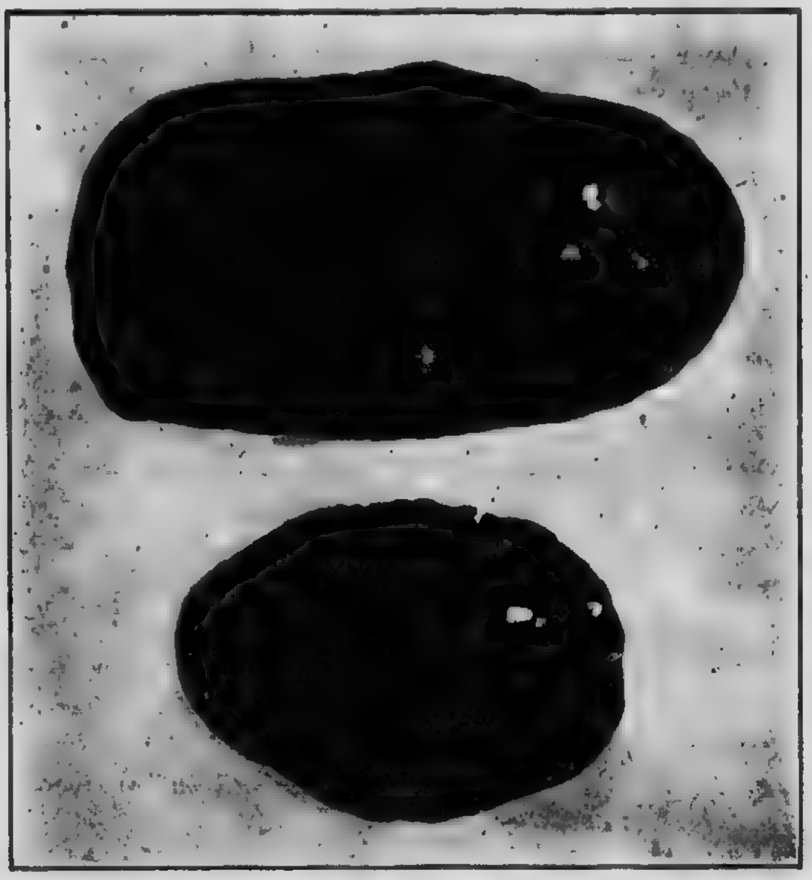
If the school grounds are not under-drained, the Board should be urged to have it done. While this is being done further instruction should be given to the pupils.

Exercise 7:

This exercise may be transferred to the month of May, but potatoes are more easily obtained in October.

Potato Scab—Treatment.—Dissolve 1 pint of formalin in 30 gallons of water and immerse the potatoes in this for two or three hours.

Or, dissolve 4 ounces of corrosive sublimate in 30 gallons of water. This cannot be used in a metal vessel. If either liquid is put into a barrel till about half full, a "gunny" sack of potatoes may be dipped in, sack and all. This sack can be left standing in a tub to drain off, and the potatoes may then be turned out to dry somewhat before cutting for "seed". Corrosive sublimate is a deadly poison and, therefore, great care must be taken, after using it, not to throw the waste material out on the grass where chickens or other animals may get at it. Formalin is, on the whole, preferable.



66. Potatoes affected with scab, a fungus disease

Barnyard manure, sod, or other organic waste favours the development of scab, but if the seed is treated there is likely to be but little danger of infection. (See Figures 65 and 66.)

NOVEMBER

(See *Ontario Agricultural College Bulletins, 194* and *216*.)

EXERCISE 1:

Ask each of the pupils to bring to school several apples belonging to two or three varieties which are common in the neighbourhood. Among these will probably be—Northern Spy, Baldwin, Snow, Bellefleur, Rhode Island Greening. From among these, two or three varieties should be selected with a view toward judging them. It will be necessary for the teacher to select from each variety the apple which approximates most nearly to the ideal type as to *size, shape, colour,* and *freedom from blemish,* and then, from the individual fruit, have the pupils do the judging, using 25 marks as a maximum for each quality.

EXERCISE 2:

From a larger number of apples, say a bushel, have the pupils select what might be considered a prize plate of five or six apples. Now, from all these groups, or plates, ask the pupils to judge the plates according to the following plan. For judging the plates, in addition to the foregoing qualities, *uniformity* in size and colour has to be considered.

	Perfect	Pupils' score
Size	15	....
Shape	15	....
Colour	15	....
Freedom from blemish	15	....
Uniformity as to size	20	....
Uniformity as to colour	20	....
	100	

EXERCISE 3:

It would be a useful exercise to work over a similar schedule for both individual fruit and for plates, with regard to two other varieties. This will be time well spent, and the pupils will enjoy the work.

EXERCISE 4:

Ask the pupils to bring pears to the class and deal with the pears as with the apples.

EXERCISE 5:

Secure two or three of the regular standard apple boxes and use them to show how apples may be packed. A bushel or two of apples should be secured for this purpose, and the pupils should be asked to pack the box once or twice, showing the different methods of packing. There are two distinct methods of arrangement of apples—one is called the diagonal and the other the square method. To box up apples with success it will be necessary to have good uniform fruit; and even then some skill and practice will be necessary in order to ensure good results. The pupils will always take a good deal of interest in anything partaking of the nature of a puzzle, and this operation is more or less of a puzzle. (*Ontario Agricultural College Bulletin, 216*)

EXERCISE 6:

At this time the method of packing such fruit as apples and pears in eleven-quart baskets should be taken up. Secure a bushel of apples, or use the same apples as were used for boxing, and arrange the apples in baskets in a way similar to that which is used in packing boxes. A neatly packed basket makes a good appearance. At the same time show how basket covers are fastened to the baskets. These lessons in packing are not only useful but they are also educative, and all the pupils will take a keen interest in the subject. If there is an expert apple packer in the neighbourhood he should be secured to give a lesson or two.

EXERCISE 7:

If the school is located in an apple district, it might be worth while to take the class to an orchard where packing is being done, in order to see the method of selecting, grading, and barrelling the fruit. If it is not convenient to do so, the pupils should be given instructions with respect to the laws relating to the grades of apples and the urgent need of honesty in packing. (Write to the Fruit Branch, Department of Agriculture, Toronto, for recent regulations, and see page 22, *Ontario Agricultural College Bulletin, 216.*)

EXERCISE 8:

Poultry.—Discuss with the class the European (Mediterranean), the Asiatic, and the Utility breeds, pointing out as far as possible the chief qualities characteristic of these groups. (See Section on Poultry, page 72, and Figures 55-60.)

WINTER WORK OF SECOND YEAR

DECEMBER

FARM ARITHMETIC

DAIRYING

(See *Ontario Agricultural College Bulletins, 205* and *206*.)

1. A four-year-old Holstein heifer produced 21886.8 lb. of milk and 795.6 lb. of milk fat in a standard milk test. Find what the milk tested in milk fat.

2. Find what the butter was worth in (1) above at 45c. a pound (100 lb. of fat produces 116 lb. butter).

3. Find the cost of the feed if she consumed, during the milking season:

6822	lb.	meal at	$75.00	a ton
22510	“	ensilage	2.00	“
2014	“	hay at	7.00	“
6875	“	green feed	3.00	“
636	“	dried beet pulp at	29.00	“

Compare the answers in (2) and (3).

4. Had the milk sold at 8c. a quart, compare the value of the butter (1 gal. water weighs 10 lb. and the sp.gr. of milk is 1.032).

5. A sends 240 lb. of milk testing 3.5, B sends 300 lb. testing 3.4, and C 360 lb. testing 3.6. Out of this milk there was made 85 lb. of cheese worth 18c. a lb.

Find the following:

(*a*) The number of lb. of milk required to make 1 lb. of cheese (correct to three places of decimals);

(*b*) The total number of lb. of fat and its value per lb.;

(*c*) Each man's share if paid according to the amount of milk sent;

(*d*) His share if paid according to the milk-fat test;

(*e*) If paid according to the milk-fat plus 2 basis.

Note on (*e*),—Casein in milk averages 2%.

6. A sends 200 lb. of milk testing 3.3 to a factory; B sends 200 lb. testing 3.5, and C 200 lb. testing 3.7. From this 53 lb. of cheese is made, worth 20c. a lb. Find what each man should receive if paid according to each of the following standards:

(*a*) The "pooling" system, that is, according to the weight of the milk test;

(*b*) The test of milk fat;

(*c*) The test of milk fat plus 2.

SPRAYING

(See Section on Spraying and also Schedule, page 164 *et seq.*)

7. Bordeaux mixture is made by mixing 4 lb. of quicklime and 4 lb. of copper sulphate with 40 gal. of water. How much lime and sulphate are required to make a pint of the mixture?

8. How many gal. of lime-sulphur testing 32° Baumé should be taken to make 500 gal. of the dormant spray (1:9)?

9. To make a summer spray of lime-sulphur 1 to 45, how many gal. of a stock testing 28° Baumé should be taken to make the proper mixture to fill a 600-gallon tank?

10. How much water must be added to 1 gal. of lime-sulphur mixture of sp.gr. 1.24 to dilute it to 1.03?

FEEDING STOCK

(See Section on Feeds for Stock.)

11. A given weight of corn ensilage contains 14.5 lb. carbohydrate, .89 lb. fat and 1.22 lb. protein. Calculate the nutritive ratio. (See page 193.)

12. 100 lb. of alfalfa hay contains 37.33 lb. carbohydrates, 1.37 lb. fat, and 6.94 lb. of protein. Calculate the nutritive ratio.

13. What nutritive ratio will the feeding of 25 lb. of clover hay and 1 pound of linseed meal produce?

14. Equal amounts by weight of corn ensilage, bran, and mangels, will give what ratio?

FERTILIZERS

(See Section on Fertilizers, page 195, and *Ontario Agricultural College Bulletin, 223.*)

15. In a 2, 10, 8 formula for fertilizers how much of each constituent is there in a ton of the commercial product? Find the amount of filler per ton of fertilizer.

16. It is required to use 380 lb. of a mixed fertilizer per acre. How much is this per square yard?

17. Two parts of a 2, 10, 8 fertilizer are mixed with 1 part of a 1, 7, 6 fertilizer. Find the proportion of the mixture.

ENSILAGE

Table showing the Weight of Ensilage at different Depths in the Silo

Depth	Weight per cubic foot	Depth	Weight per cubic foot	Depth	Weight per cubic foot
ft.	lb.	ft.	lb.	ft.	lb.
10	26.1	19	32.6	28	38.4
11	26.8	20	33.3	29	39.0
12	27.6	21	33.9	30	39.6
13	28.3	22	34.6	31	40.1
14	29.1	23	35.3	32	40.7
15	29.8	24	35.9	33	41.2
16	30.5	25	36.5	34	41.8
17	31.2	26	37.2	35	42.3
18	31.9	27	37.8	36	42.8

18. A silo 20 feet in diameter needs about 2100 lb. of ensilage on the surface to keep it from spoiling. Assuming that ensilage keeps for one day, the minimum that should be fed daily is 2100 lb., and this includes a depth of how many inches? (See Table above, and also Section on Silos, page 182.)

19. A silo is 20 ft. in diameter and 36 ft. high. What is the least number of cows that must be kept, to prevent the ensilage from spoiling, if each cow is fed 40 lb. daily?

20. If a silo is 18 ft. in diameter, inside measurements, and 32 ft. high, how many cubic yards of concrete will it take to build the silo if the wall and floor are each 6 in. thick, and the foundation is 8 in. thick and 5 ft. deep?

GENERAL

21. What fraction of a square 10-acre field is cut in 10 rounds by a binder with 6-foot cut?

22. If a sheaf of grain averages 7 in. in diameter and a 6-foot binder puts off a sheaf every 16 ft., what length of binder twine will it take to tie a 10-acre field assuming $3\frac{1}{2}$ in. for each knot?
23. If a potato set weighs one ounce, calculate the weight of potatoes necessary to plant an acre when the rows are 30 in. apart and the sets 14 in. apart in the row.
24. From the same weights of set, how many bushels of potatoes would be required to plant an acre in hills 3 ft. apart each way and 3 sets to a hill?

FARM BUILDINGS AND MACHINERY

Ask the pupils to note particularly any good farm buildings in the neighbourhood. Point out the chief essentials contributing toward good buildings: grain barn, horse stable, cow stable, silo, pig-pen, sheep pens, poultry buildings, machinery sheds for wagons and other farm machinery.

Point out the effects of sun and rain upon exposed farm implements, as in the warping and splitting of the wooden parts of a mower or reaper. Show the effects of rust upon iron.

Point out the value of improved machinery in economizing labour. One man with a four-horse team and a two-furrow plough can do the work of two men, each provided with a single-furrow plough.

Compare the machinery used forty years ago with that in use now. The pupils should be asked to consult their parents in this regard. This will provide an important practical lesson in recent developments in farm equipment.

Care of tools.—This subject is best taken in connection with the work of the school garden.

JANUARY

EXERCISES 1, 2, 3:

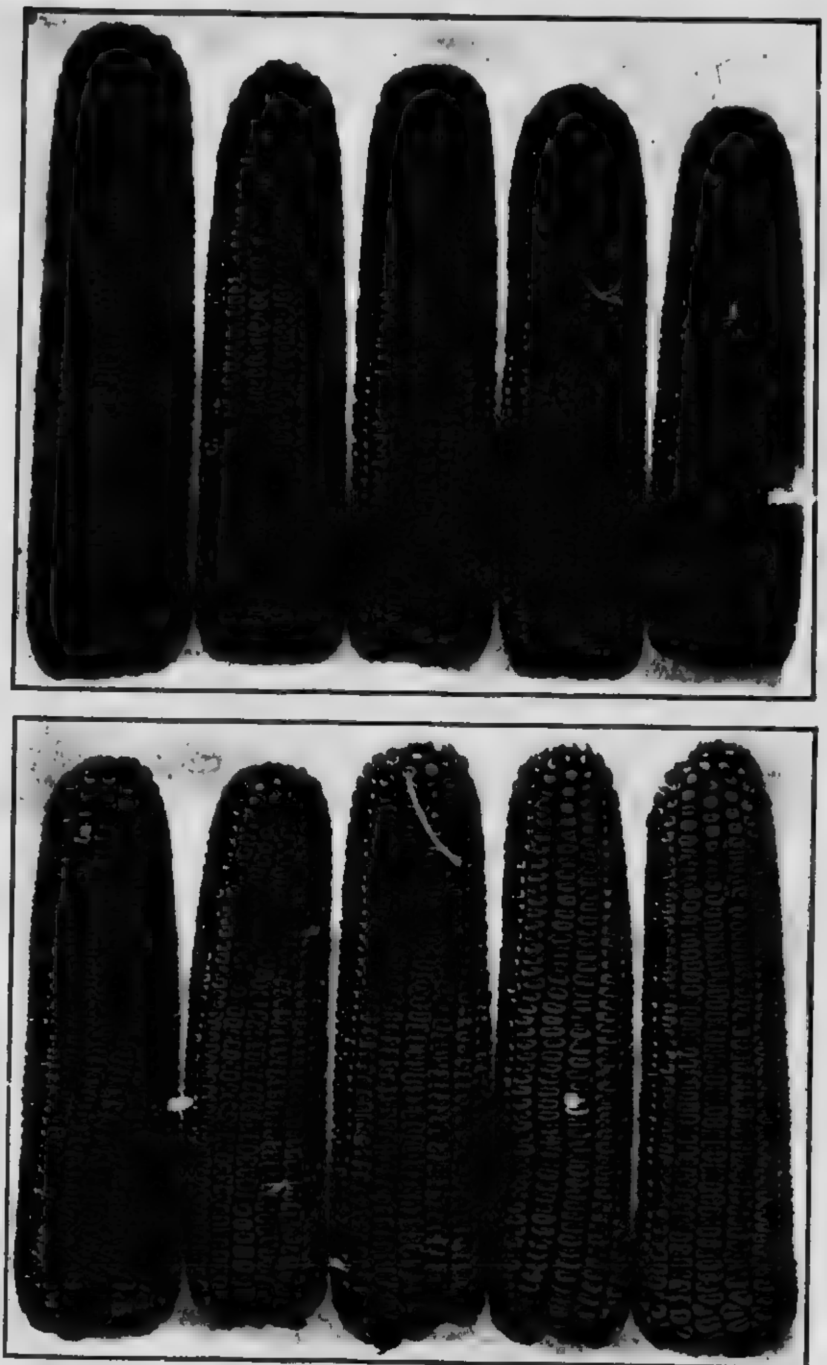
Samples of different kinds of grain should be brought to the class by the pupils as a preparation for grain judging. Instruction should be given as to the chief features to be considered in arriving at a conclusion regarding the ideal type of kernel. Each pupil is given half a saucerful of each sample of grain to be judged, and is then asked to proceed according to the following:

Thrashed grain	Perfect score	Student's score
Seed condition (mature, dry, plump) . .	20	. . .
Colour of grain	05	. . .
Uniformity	25	. . .
Purity (freedom from foreign material)	25	. . .
Weight per bushel . . . . (wheat 60, oats 34, barley 48) Cut 2 points for each pound below standard and add 3 points for each pound above.	25	. . .
	100	

Great improvement may be made in grain for seed by putting it through a good fanning-mill and grain-grader. In selecting grain for seed great care should be taken to get the best variety found in the locality, and the best of the best variety is none too good.

EXERCISE 4:

From the best lots of the grains judged, individual grains which approach the ideal type should be selected. This hand-picked seed should be used in the school or



67. Prize corn (Dent) Collection for lesson on corn judging

home gardens, and should be followed up even to the selection of the best heads at harvest time. The harvest, of course, comes at a time when the schools are closed for vacation but, if sufficient interest has been aroused among the pupils, there will be no difficulty in getting them to make selections at the proper time. The heads selected should be carefully preserved in a place where

Flint
68. ~~Dent~~ corn

Dent
~~Flint~~ corn

Plate — corrected

they cannot be reached by mice, and should be used the following year. From these heads further selections might be made, and the selected grain planted again. If this process of selection be kept up, there is no reason why every school could not do something toward improving the total crop of the country, and even toward producing new varieties of grain.

Exercise 5:

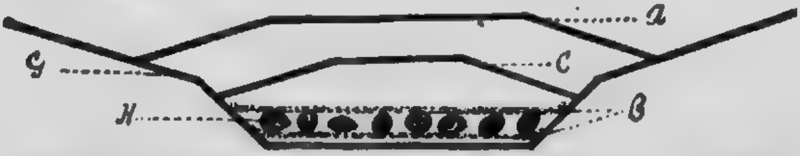
Comparison of heads of oats, wheat, barley, and rye.—From small sheaves of different grains collected by the pupils during the month of July have them make comparisons showing the structure of the *head* (in wheat, barley, rye) and *panicle* (in oats). Compare the ear of corn with the head of wheat. They resemble each other more than at first appears. Have samples in class for purposes of comparison.

Exercise 6:

Compare the grains of oats and wheat. Note that a portion of the chaff adheres to the oat grain. Compare oats with barley and with rye. Some attempt might be made to judge the heads of these grains.

Exercise 7:

Select a certain number of kernels of the different groups of corn or other grain to be tested, and soak them over night—in any case not more than one day. Then place each group in a soup-plate. On top of this place a wet cloth, and on top of this a saucer, then a small plate, making sure that all the groups of kernels are placed in similar conditions. In two or three days the kernels may be uncovered and examined. Those showing the greatest development are evidently the most vigorous kernels. (See Figure 69.)



69. Simple form of germinator. G, soup-plate; B, cloth or blotting-paper; H, seeds; C, saucer inverted; A, small dinner plate inverted. Note.—The cloth (B) must not project outside of C, because of the drying effect of the air and the capillary attraction of the cloth.

EXERCISE 8:

A test similar to the above might be made, to compare the kernels taken from the middle of the ear with those from the ends. It has been stated that kernels from the middle of the ear produce from ten to twenty per cent. better results than those from either end of the ear. (The "rag doll" test referred to on page 85 may be made use of here.)

EXERCISE 9:

Fill a tall glass jar with sand, and in it, near the glass, place at different depths kernels of corn which have been soaked in water for a day. Have the sand moist but not wet. Leave the jar in a dark place for several days. It should be noted that corn is a plant requiring considerable heat, much more than wheat. Draw conclusions in regard to the proper depth of planting. (See *Elementary Principles of Agriculture,* Ferguson & Lewis, page 20.)

EXERCISE 10:

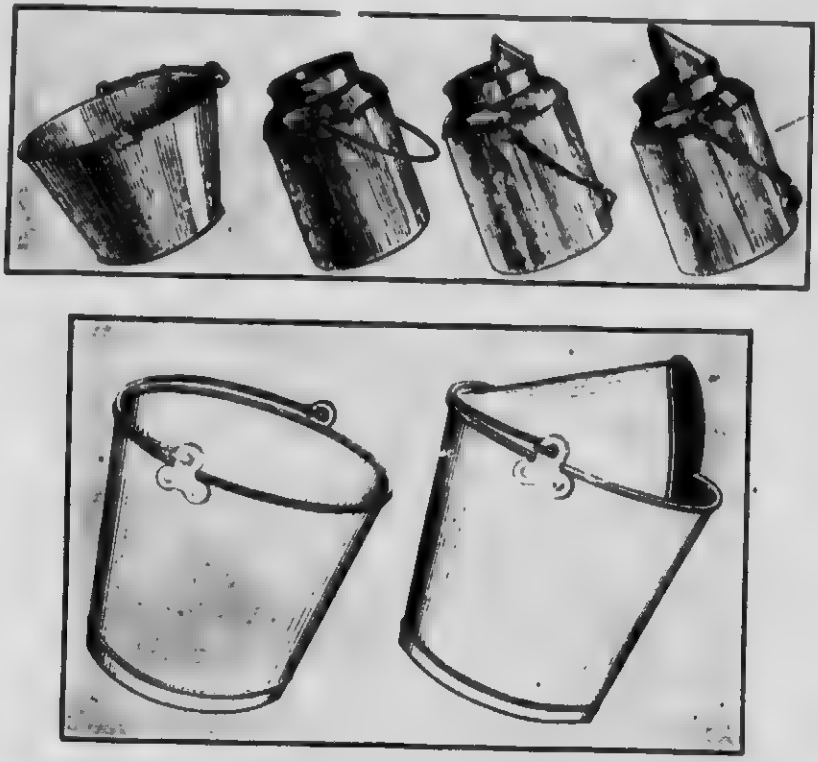
Secure from the Department of Agriculture at Ottawa samples of low grades of seed, and have the pupils count the weed seeds in a given weight of material supplied. In identifying the commoner forms let them use the collection made during the first year. See list on page 16.

FEBRUARY

EXERCISE 1:

Secure a Babcock testing outfit of two or four vials, which consists essentially of the revolving separator, two or four milk vials, a measuring pipette, an acid measurer, and a bottle of sulphuric acid. (See *Canadian Dairying,* Dean, page 68, for details of this operation.)

Ask several of the pupils to bring average samples of milk. If the tester has four vials, four samples may be tested at once. Hot water is necessary to bring the milk fat up into the neck of the vial. The percentage of milk fat is read on the neck of the vial, and this indicates, though not exactly, the number of pounds of milk fat in a hundred pounds of milk. As butter is composed of water and other material as well as of milk fat, the amount of butter per hundredweight of milk will be considerably more than that indicated in the milk-fat reading. It will be about one fifth more, but this will depend on how much



70. Milking pails. The use of the ones illustrated on the right reduces danger from dust and germs

water may be held in the butter. Therefore, if milk were to test four per cent. of milk fat, it would mean about $6/5 \times 4 = 4.8$ pounds of butter would be produced from 100 pounds of the whole milk. It should be noted that the milk must be an average sample of all the milk given at a milking. That which is last milked is richer in milk fat than the rest. This has been called "strippings".

The Babcock test briefly is that 17.6 cc (18 grams) of milk are mixed with about 17 or 18 cc of sulphuric acid (the mixture becomes very hot), and placed in vials whose necks are graded to read the actual amount of fat per hundred of the milk tested. Special vials must be secured for testing cream, and others again for whey or skim milk.

The testing of milk may be done at any time of the year which may be found convenient, as, in the country, milk may be had whenever required.

EXERCISE 2:

At the time the Babcock test is being carried on, another method might be adopted. Secure half-a-dozen tall test-tubes and put samples of milk in the tubes, then let them stand for a day. The cream rises to the top and may be compared roughly with the Babcock test. Three common methods are employed to separate cream from milk—the separator, the tall cans, and the flat pans. The first of these, if properly adjusted, gives the best, and the last the poorest, results.

EXERCISE 3:

While dealing with the question of milk, instruction should be given on the care of milk, pasteurization, etc.

EXERCISE 4:

Partly fill two test-tubes with milk of the same kind. Heat one of them over a spirit-lamp until it is nearly boiling, or to about 65° C. or, 140° F., and heat again in fifteen minutes or half an hour to the same temperature; then plug both test-tubes with cotton plugs and leave them under the same conditions for a day or two. Test from time to time after this by taste or with litmus paper, to ascertain which becomes sour first.

Exercises 5 and 6:

To determine roughly the composition of milk, secure a pint of milk and let it stand over night. In the morning skim the cream off the top and place this cream in a fruit jar, then shake thoroughly (churning). The fat collects and forms butter, and most of this is separated out by churning. To a portion of the skim milk add a little vinegar and let it stand until the milk becomes thick. This thick material is roughly the casein, which is the chief constituent of cheese. The watery portion separated out from the thick mass is the whey. Heat the whey to about 165° F., and note the glairy portion on the top. This is the albumen and may be skimmed off. After separating the albumen, place a portion of the remainder on a flat dish to evaporate by gentle heat. When evaporated down to dryness, a solid mass remains which is composed of milk sugar and ash. The milk sugar may be removed by heating on a piece of mica or in a tablespoon over a flame. The sugar burns away and the ash remains. Milk, therefore, contains fat, casein, albumen, water, sugar, and ash.

Exercise 7:

Secure, with the aid of the pupils, different samples of butter, some of which may be good and some not. Compare as to odour, colour, and taste. If any of it is "rancid", test for acid. Give explanations of the reasons for keeping butter under suitable conditions and in proper surroundings. Show the pupils samples of butter colour. Describe the process of churning, mixing, and salting butter. Emphasize the importance of cleanliness, proper temperature, and mixing. (See *Canadian Dairying,* Dean, page 107.)

EXERCISE 8:

Write to a dealer in fertilizers for samples of the various kinds, mixed and unmixed. These may be kept in glass bottles for future use as museum specimens. Shake up in water a portion of each, and let them stand over night. Then test with litmus paper to see whether they are acid or not. Examine the colour and the odour.

EXERCISE 9:

Have the pupils calculate the amount of fertilizer per square yard, having given the amount per acre. How much should be applied to one square rod if the amount per acre is 340 lb.?

EXERCISE 10:

Having calculated the amount of fertilizer required per square rod, have the pupils weigh out a suitable amount for the school or home garden, and apply as a test to show whether the fertilizer can be used profitably. It must be noted that commercial fertilizers are not always profitable to use, because the increase in crop, if any, may not pay for the extra expense and trouble. In fact it quite frequently happens that there is no increase at all, and there is a disappointment. Nevertheless it should be pointed out that experiments are necessary. Read the Section on Fertilizers, page 195.

SPRING WORK OF SECOND YEAR

MARCH

EXERCISE 1:

In order to graft successfully, the cuttings called scions should be selected in the month of March while the buds are in the dormant state, and should be kept dormant in a cool, damp place until used. The scions should be taken from a one-year-old twig. A sucker, or water sprout, if you are sure of the variety, makes a good scion. Each scion should be cut so as to have but two or three buds. Let the pupils do the selecting and cutting. (See Figures 71 and 71*a*.)

EXERCISE 2:

If there is a tree in or near the school yard, the class should be taken to it; if not, ask a few of the larger boys to bring to the class a large limb taken from some neighbour's tree, if permission can be obtained. This should be brought into the school-room. With shears, knife, and saw, show:

(*a*) How to make a clean cut with as little haggling as possible, and also the importance of such a cut,

(*b*) The importance of cutting a branch close to the limb, so that the wound may heal over,

(*c*) The importance of removing weak or dying branches and those which tend to overcrowd.

If the limb brought to school has been pruned the year before, illustrations of healing-over may be seen.

EXERCISE 3:

Ask the pupils to bring a bottleful of lime-sulphur solution to school; fill the hydrometer jar, and place the hydrometer in the liquid, noting the reading. Dilute with an equal volume of water and try again. Have the pupils do the work and make the readings. If the school is in a fruit-growing district, there will be no difficulty in getting lime-sulphur.

The lime-sulphur liquid used for the dormant spray (before the buds open) is usually about 1 of the "stock solution" to 9 of water. This stock gives a specific gravity of about 1.315, which is about 35° Baumé.

Certain hydrometers reading from 25° to 35° Baumé are in use, and if the Baumé reading is given it simply means the relative specific gravity. The following table shows the Baumé reading, the specific gravity, and the proportions of stock solution to a *one-to-nine* dormant spray:

Baumé	Specific gravity	Proportions of stock and water
35	1.317	1:9
34	1.305	1:8¾
33	1.293	1:8
32	1.282	1:7¾
31	1.271	1:7½
30	1.260	1:7
29	1.250	1:6¾
28	1.240	1:6½
27	1.230	1:6
26	1.219	1:5¾
25	1.208	1:5½

Here is an example to show how this works: Suppose our stock in the barrel tests 29° Baumé, and we want a one-to-nine dormant spray, we take one of the stock to 6¾ of water. If it reads 27° Baumé, we take one to six, and so on. But suppose we should want a summer spray of 1 to 45, we should then increase the amount of water by multiplying by 5. For example, suppose our stock tests 33° Baumé, we should then add 5 times 8, or 40 of water to one of stock. Ask the pupils to bring from home samples of the stock, and test them out, showing in what proportions stock and water must be mixed to get 1 to 9, 1 to 36, or 1 to 45.

Discuss with the pupils the life histories of the codling-moth and the tent caterpillar. In this connection show the use of a spraying machine. A knapsack sprayer (air pressure) should be part of the equipment of the school. Give a lesson on spraying. (See Section on Spraying, and Spray Calendar, page 164 *et seq.*, and also *Ontario Agricultural College Bulletin, 198.*)

EXERCISE 4:

Make arrangements to secure seeds for planting in the garden as soon as weather permits. Order from the seedsman early, so that each student may have time to test some of the seeds for relative vitality by germination.

Carefully pick out one hundred of the seeds to be tested and, after soaking them over night, place them under a cloth or blotting-paper in the germinator, as indicated on page 117. Alfalfa, clover, carrots, celery, etc., are well adapted for a lesson on germination. If the nights happen to be cold and there is no fire in the room, this germination test should be deferred or done at home. Each pupil should study, in this way, the seed he expects to plant. A good lesson should here be given on percentage.

EXERCISE 5:

In a hotbed even as small as the one described on page 83, a large number of plants may be started, and later on transplanted to the garden. Such plants as tomatoes, cabbage, celery, and cauliflower, require transplanting to produce the best results. A few early radishes and lettuce may also be grown for table use without transplanting.

The hotbed should be placed so that it will receive plenty of sunlight and, if it is sheltered from the wind, so much the better. Sometimes a little manure is banked up on the outside of the frame, to guard against loss of heat. The manure is good for only one year for a hotbed, but as soon as the hotbed season is past it may be used for garden manure. (See Figure 61.)

The following table gives a rough estimate of the requirements for planting and thinning the common vegetables:

Kind of Vegetable	Seeds or plants required for 100 ft. row	Distance apart of plants thinned or set in rows
Asparagus plants	60.80 plants	18 inches
Beans (bush)	1 pint	4 to 6 inches
Beets	2 ounces	2 to 3 inches
Cabbage (early)	¼ ounce	18 inches
Cabbage (late)	¼ "	2 feet
Carrot	1 "	1 to 2 inches
Cauliflower	¼ "	1½ to 2 feet
Celery	¼ "	3 to 6 inches
Corn (sweet)	½ pint	3 feet in hills; 15 inches in row
Cucumbers	½ ounce	3 feet
Lettuce	½ "	2 to 6 inches, leaf; head, 8 to 10 inches
Melon (musk)	½ "	4 to 6 feet, hills
Melon (water)	1 "	6 feet, hills
Onions (seeds)	1 "	2 inches
Onions (sets)	1 quart sets.	3 inches
Egyptian perennial	1 " "	1 inch
Onions (transplanted)	1 " "	3 inches

Kind of Vegetable	Seeds or plants required for 100 ft. row	Distance apart of plants thinned or set in rows
Parsley	¼ ounce	2 inches
Parsnip	½ "	3 to 4 inches
Peas	½ pint	2 inches
Potato (Irish)	5 pounds	12 to 15 inches
Pumpkin	1 ounce	6 feet, hills
Radish	1 "	1 inch
Rhubarb (plants)	33 plants	3 feet
Salsify	1 ounce	2 inches
Spinach	1 "	4 to 6 inches
Squash (winter)	1 "	6 feet, hills
Squash (summer)	1 "	3 to 4 feet, hills
Swiss chard	½ "	8 to 10 inches
Tomatoes	¼ "	3 feet
Turnip (Swede)	½ "	6 to 12 inches

With regard to the depth at which seed should be planted, no very definite statements can be made. However, it may be said generally that the larger the seed the deeper the planting. Moreover, if the soil is dry the seed should be planted deeper. In early spring the chief factor promoting germination is heat, moisture being so general. It is, therefore, important that seed should be planted very shallow in early spring.

For large kernels, such as corn or beans, a fair depth would be 1½ to 2 inches, and for small seed, such as lettuce, ½ inch to 1 inch.

APRIL

EXERCISE 1:

The plan for the school garden should have careful consideration as a class study. The conditions bearing upon the garden should be taken up under the following heads: (*a*) Location with respect to buildings, fences, and road; (*b*) amount of land required to give the best results, the number of pupils being taken into account; (*c*) the shape of the plot best adapted to the grounds; (*d*) the relative proportions of area to be devoted to individual and community plots (see Figures 8-11).

EXERCISE 2:

In laying out plans of the garden, attention should be drawn to the amount of unoccupied land lying under paths, and the pupils should make calculations showing the actual unoccupied area. Economy of ground is an important lesson to teach, and this opportunity should be made use of. (See Figure 8.)

EXERCISE 3:

Intensive Gardening.—The term implies a minimum of space with a maximum of crop, an important consideration for those with small gardens. This is accomplished, generally, by growing two crops, one after the other, or both, in part, at the same time. A list of those crops which are harvested early should be made by the pupils, and from this list a selection should be made. The crops harvested late in the season should be put in a separate list, and a study of these should be made, with a view to adapting a selection from the latter to go with some from the former. For example—a crop of radishes may be harvested before the potatoes (late potatoes) are planted. Early beets may be sown between rows of corn, the beets being harvested before the corn is required. Early spinach can be followed by late cabbage, and so on.

EXERCISE 4:

Another method of intensive gardening may be carried out by the use of a three-foot poultry wire along the edge of the plot. Cucumbers, melons, and even tomatoes may be trained up along the wire, thus leaving room for other plants close by. These problems are all of high educational value, aside from the practical application. Intensive gardening of some form or other should be practised every year by at least some of the pupils.

Almost any kind of plants may be started in cold frames—cabbage, cauliflower, tomatoes, cucumbers, melons, etc.

MAY

EXERCISE 1:

Ask some of the pupils to bring samples of the stock solution of lime-sulphur mixture and, by the use of the hydrometer, test the given samples to show the use of the table in the Section on Spraying. Refer to the Exercises for March, page 123.

EXERCISE 2:

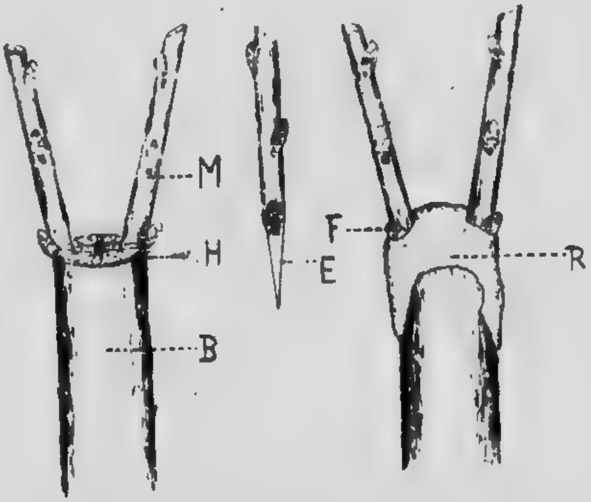
Prepare a strong and a dilute solution of common salt and compare the results (*a*) with well-water, and (*b*) with stock solution of lime-sulphur. At this time a lactometer test might be used in connection with the other hydrometer tests. The lactometer is nothing more than a closely graded milk hydrometer for liquids heavier than water.

EXERCISE 3:

Secure samples of whole milk, cream, and buttermilk. Have the pupils see that the lactometer floats at different heights in the different liquids. Then mix with the whole milk about one third the amount of water and compare the results.

Exercise 4:

Grafting.—Have the pupils bring branches of apple-trees (branches of any kind of trees might do) to the class, so that methods of grafting may be demonstrated. For the ordinary cleft grafting see the illustration. (There should be a set of grafting tools in the school.) Have the pupils practise cutting the scion and splitting the stock, giving attention to the various details. Note that scions are to be placed at a small angle, and not parallel to the axis of the stock, when inserted in it. This is to ensure contact of cambium of the scion with cambium of the stock. (See Figures 71 and 71*a*.)

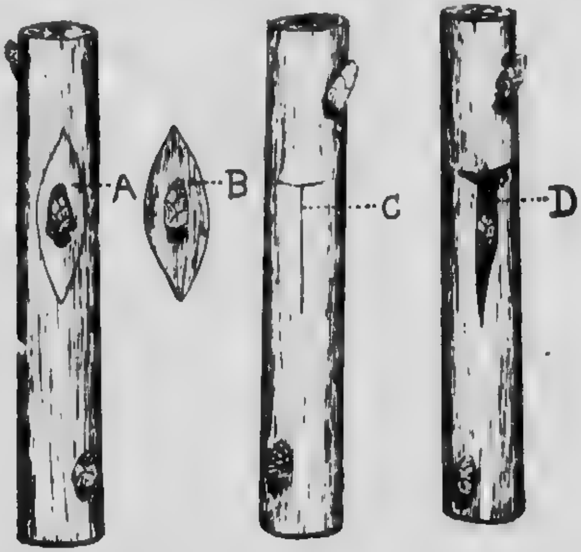


71. Cleft grafting. M, scion; B, stock; H, cambium layer; E, scion cut in the form of a wedge; R, wax covering the wound completely; F, bud peeping out from the wax; this bud is most likely to develop.

Exercise 5:

(Forms III and IV might be combined for Exercises 5, 6, and 7.)

Budding is a simple method of grafting and can be done readily with ordinary care. (See illustrations and *Essentials of Agriculture*, Waters, pages 11 and 41.) Have the pupils practise this work several times in class and induce them to try the operation at home. Budding may be done late in the summer.



71 (*a*). Budding (grafting). A, area on the bark marked for cutting; B, bud removed; C, cleft in the stock marked for cutting; D, bud inserted in stock.

Cleft grafting is usually done in May even after the leaves are out, but the scions must have been taken early in the spring and kept in a cool place, to prevent the buds from developing. The buds of the scion must be dormant at the time of grafting. For cleft grafting the teacher might furnish grafting wax to the pupils. The following should be discussed in class: cambium layer, healing of wounds, loss of water by evaporation, importance of wax, etc. (Examine Figures 71 and 71*a* minutely.)

RECIPES FOR GRAFTING WAX

1. Tallow, one half pound
Beeswax, one pound
Rosin, two pounds.

Melt together in a tin pail and turn out into a pail of cold water. If the hands are greased the wax may be handled without sticking.

2. Another wax may be made as follows:
Rosin, one pound
Beeswax, one half pound
Linseed oil, one half pint.

Melt together, and while melted stir thoroughly. This is not so sticky as Number 1 and should be quite soft.

EXERCISE 6:

If the school is provided with an incubator, the pupils should be induced to bring eggs, so that each pupil may have an interest in the success of the hatch.

The directions usually found accompanying the incubator should be followed carefully. Attention should be directed to the importance of (*a*) turning, (*b*) cooling, and (*c*) moisture. After a week or so the eggs should be candled for fertility, and some of the infertile ones should be removed. The other infertile eggs should be marked and replaced in the incubator for further demonstration. Always remember that the operation is an educational one, the aim being to get as much information as possible.

EXERCISE 7:

The eggs should be candled again, perhaps two or three times, to see the changes. It will be found an interesting operation to break an egg, from time to time, into a saucer or plate, to see the development of the young chick.

Exercise 8:

Exercise 7, page 104, might well be repeated here, especially if potatoes are to be planted in the school garden.

For beautifying the school grounds see the Section bearing upon this subject, page 152, and call attention to Arbor Day improvements.

JUNE

Exercise 1:

The pupils should have time provided on the regular programme for school garden work, as well as for the discussion of the principles involved in the cultivation of the soil, uprooting of weeds, etc., and they should be given a fairly free hand to work out their own problems.

Exercise 2:

Arrangements should be made in June to care for the gardens during the summer vacation. The best method is to have the summer work done by the pupils, either individually or in groups, having the time divided so that all those interested in the garden may have an opportunity to attend to the plants for some part of the time. If it is difficult to make this arrangement, the teacher should see that plants which require the minimum of attention during the summer are grown. In any case, however, the garden should never be left uncared for, even if labour has to be hired.

Exercise 3:

(This Exercise may be taken in some localities in May.)

At this season of the year many insects are either hatching from the eggs or are changing from the pupa to the adult. Have the pupils look for eggs of the tent caterpillar. It may be rather late now for this, but if the pupils understand the life history of this insect there will be no difficulty in finding the eggs. They were laid in clusters the year before, encircling the twig, and they hatch out when the leaves are developing in the early summer. Attention should be called here to the method of destroying the pest. (Refer to *Insect Pests of Farm, Garden, or Orchard,* Sanderson, page 608.)

EXERCISE 4:

Early in June potato beetles may be found in the soil, emerging from the chrysalis into the well-known hard-winged adult form. Some of these should be put in a box to show the development of the adult. The whole life history of three or four insects should be gone over carefully for review, so that the pupils will understand that one individual passes through all the stages. The most destructive insects, if not the best known, are the codling-moth, the tent caterpillar, and the potato beetle.

EXERCISE 5:

Attention should be called also to the bot-fly, sheep-ticks, and poultry vermin. The destructive insects of the house are carpet moth, buffalo moth, and those which, under careless conditions, affect the persons of human beings. Point out remedies. (Refer to *Insect Pests of Farm, Garden, or Orchard,* Sanderson, pages 143, 233, 240, etc.).

EXERCISE 6:

(Forms III and IV may be combined for this Exercise.)

House-flies.—The life history of this insect should be explained, and attention should be called to the fact that house-flies are among the chief carriers of disease from one human being to another, because they seek filthy places for breeding grounds and then fly about in the kitchen, depositing germs of disease upon every thing they touch. Intestinal diseases, of which typhoid is an example, may be carried by house-flies. Many diseases of the respiratory system, such as tuberculosis, are also spread by them. Around the farm, house-flies are always a great pest because of the stock kept close by. It is impossible to destroy the breeding grounds (manure piles), but it is possible to screen the dwelling-house so as to exclude the flies almost altogether.

The screening of windows and doors at school should receive attention, partly for the protection of the pupils and partly as an object lesson to the farmers.

Point out the importance of screening stable doors and windows in urban centres, and read the Bulletin of the Board of Health in reference to this. (See Exercises in Form III, September, page 19, and also Figures 2 and 3.)

At this time the note-books covering the two years should be submitted for examination, and those pupils having the best notes might be asked to enter the books for competition at the School Fair.

SCHOOL GARDENS FOR PUBLIC AND SEPARATE SCHOOLS

ILLUSTRATIVE PLANS

The different types of school gardens illustrated should be carefully studied, with a view to adapting one of them to the grounds of the school. Each illustration is intended to show some special type and is planned so as to permit of a certain amount of modification. (Figures 8-11 and 72, 73)

AMOUNT OF LAND NEEDED

As a general rule the garden should be conveniently situated with reference to the school. It should be a part of the school grounds if there is sufficient room, but in no case must it encroach upon the playground so as to hinder the ordinary games of the pupils. The minimum area is six square rods, but it is expected that, for experimental, or demonstration work, a larger area will be provided. It should be remembered, however, that a small plot well kept is more effective than a large one poorly kept.

SCHOOL GROUNDS TO BE CARED FOR

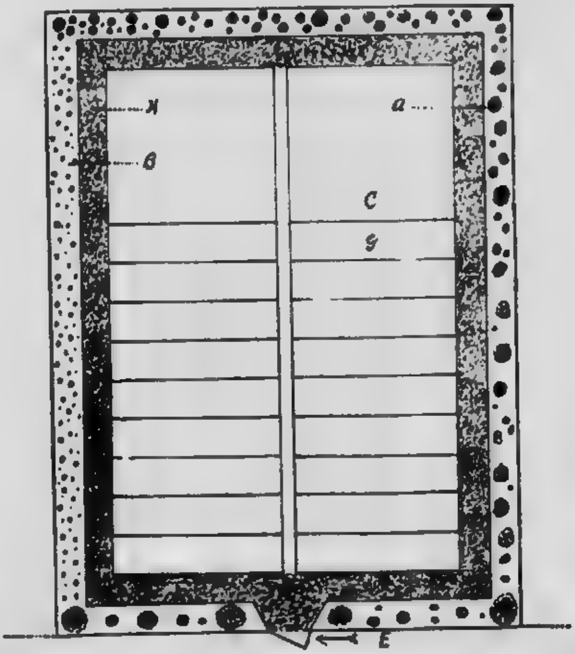
In connection with the school garden work it may be laid down as a general requirement that the school grounds not included in the plots shall be looked after. This means that attention must be given to tree-planting and shrubbery, as well as to the grass and flower-beds. Though not specifically stated in the Regulations, no Inspector should approve, for grants, a school garden where the school grounds have been allowed to become weed-grown.

SECURING ADDITIONAL LAND

Where it is not possible, owing to small or unsuitable grounds, to provide sufficient space for the use of the pupils, it would be well to rent or purchase additional land in a suitable place. For preparing and fencing this land a portion of the school grants may be available. When land is being rented or purchased, it would be advisable to secure sufficient, not only for the present needs, but also for the future.

GENERAL PLANS

The plans for a garden suitable for a country school will vary considerably with varying conditions; consequently, no one plan can be recommended for all. This is a matter that must be considered by the teacher in charge of the school at the time the garden is decided upon. As a general rule the secretary of the Board and the Inspector should be consulted, as these men should be able to give useful assistance, because they can view the school-garden proposition from a different angle, and are, as a rule, longer in office than the teacher.



72. School garden where the whole plot (fenced in) is used. H, grass; B, wild flowers; A, perennial border; E, gate; C, community, or class, plot; G, individual plots. Space economized.

In planning a garden there are a few general suggestions that should be considered. The shade of trees and buildings should be avoided, and the land should be well drained. Under-drainage (tile drainage) is a very important factor, because, to get the best results, the ground should be capable of being worked early in the spring. Schools close early in the summer, and the utmost use must be made of the spring term. Moreover, a well-drained garden may be made an object lesson to the neighbourhood in the matter of drainage. When laying out a school garden the District Representative of the Department of Agriculture should be consulted, or if the school is situated near a High School which has a teacher of Agriculture, he may with profit be consulted. (See Figures 8-11 and 72-73.)

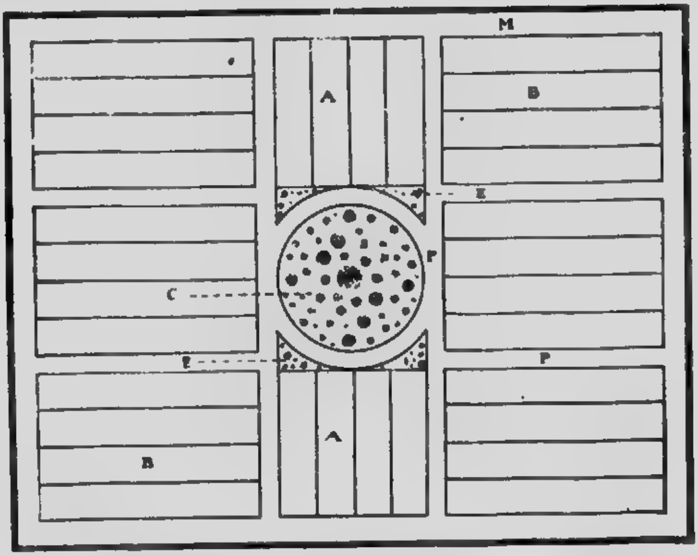
INDIVIDUAL PLOTS

With respect to the assignment of plots it might be said that, as a rule, each pupil should have a plot of his own, but if, on account of the size of the class, conditions do not permit of this, it would be well to modify the arrangement by assigning a plot to two pupils or perhaps more. It is useful, in addition, to have one or more plots in which all are interested.

Paths should be so arranged that most of the work can be done without trampling on the plots, and these paths should be wide enough to be in keeping with the general size of the garden and the plots. If paths can be kept lightly cultivated on top, so much the better. This will prevent some loss of moisture and will facilitate the destruction of weeds.

RAISING PLOTS ABOVE THE LEVEL

The question as to whether beds should be raised above the general level of the paths, is one which is not easily answered in one statement. As a general rule, however, it may be said that level beds are preferred. But in cases where surface drainage is an important factor, it might be advisable to raise the beds above the level of the paths.



73. School garden with central ornamentation suitable for a city school of eight classes. C, perennials; E, perennials; A, individual plots for smaller classes; B, larger individual plots; P, paths at least two feet wide; M, border, which may be left in sod or cultivated.

PLANTING

In planting a garden the local conditions should be taken into consideration, and the garden should represent, to some extent, the locality. Two classes of products, however, should always have a place—vegetables and flowers—

a combination of the useful and the ornamental. As a general rule, plants which are easily grown should be assigned to the younger pupils; to the older and more advanced some problems in experimentation should be given, and these problems should be varied from year to year. The advice of farmers in the neighbourhood may be sought, to assist in this work of experimentation, because it will be found necessary to secure help during the summer vacation, and farmers will be willing enough to help if problems are undertaken in which they are directly interested. Such problems as "the comparison of inoculated or non-inoculated seed of alfalfa", "the importance of using selected seed grain", "the introduction of a new variety of grain or potato", will probably interest the farmer and secure his co-operation.

WATERING GARDEN PLANTS

With respect to the watering of plants a few hints may be given. Ordinarily, no artificial watering is needed, except for plants at the time of transplanting. When plants have made a good start, the moisture conditions can be secured by cultivation. In fact, if plants are watered in dry weather in the ordinary way, actual injury may result, because they are likely to send out young rootlets near the surface where the water has been supplied and then, during the following day, when the sun is hot, these rootlets will very likely be destroyed. Given a fair chance, plants can in most cases adapt themselves to dry weather, by sending their roots deeper into the ground. Of course, if water is plentifully supplied artificially, so as to keep the ground constantly moist, it will prove beneficial, but this is scarcely possible in ordinary circumstances.

USE TO WHICH CROP SHOULD BE PUT

The harvesting and disposing of the crop from a school garden is somewhat difficult to manage, as vacation comes at a time when a considerable amount of the crop must be harvested.

Where there is a School Fair, each school should make an attempt, as a school, to produce a creditable exhibit from the school garden. In cases where there is a considerable area under cultivation and the crop is worth while, the produce may be disposed of and the funds given to some charitable institution or used for the purchase of material for the use of the school. It should never be allowed to go to waste.

HOME GARDENS AND PROJECTS

Where Agriculture is taught, either home gardens or school gardens are necessary, in order that there may be some practice in individual work. The work in such gardens is considered " laboratory work ".

MANAGING HOME PROJECTS

The actual work in home gardens is difficult to manage, because it is necessary for the teacher to visit the homes to give individual instruction and guidance. If it is followed up thoroughly, however, the results are important and far-reaching. Before practical work is commenced on a project, the matter should be discussed carefully with the pupils, and the teacher should see that they have a good idea of the aim and purpose of the project and of the methods to be employed. This will require discussion and directed reading, and the likes and dislikes of the pupils should receive careful consideration. Where several pupils undertake the same projects, as may be arranged under the School Progress Clubs, the matter becomes simplified.

Only general projects of a simple character should be attempted at the beginning and, as the pupils advance, more difficult problems may be undertaken.

VISITING THE PUPILS AT THEIR HOMES

It should be a part of the teacher's duties to visit the pupils two or three times during the season, to discuss with them details of management and to give instruction when necessary. The first visit should be made soon after the project has been started and another in the autumn toward the close of the season. Other visits should be made when possible. This work of supervision by the teacher will be productive of good, from the very fact that he will be able to see the pupil at his home and to talk over matters of mutual benefit. In most cases the parents take a deep interest in the work of their children, and they can often give the teacher good advice and assistance, not only in connection with the work of the project, but also in other features of school work.

VISITS BY THE DISTRICT REPRESENTATIVE OF THE DEPARTMENT OF AGRICULTURE

Where there is a county representative with a school fair organization, some of this work of visiting should fall upon the shoulders of the representative, but it should not be left entirely to him, because, quite frequently, some members of the classes do not undertake problems under his direction, and these would be left out of consideration unless the regular teacher takes the matter in hand and provides for such cases. Moreover, the district representative is unable to make more than one visit, or at most two visits, to the pupils' homes, and thus they receive, quite frequently, too meagre an amount of instruction.

Home projects are highly recommended as a part of the Course in Agriculture and, when undertaken, should be followed up by the teacher. The following are suggested as suitable for Forms III and IV:

1. To take charge of the home vegetable garden or part of it;
2. To establish, improve, or care for the home lawn;
3. To establish a perennial flower border;
4. To test two varieties of a vegetable;
5. To grow new kinds of vegetables;
6. To establish a wild-flower garden at home;
7. To set out and care for one or more fruit trees or grapevines;
8. To raise shade trees from seeds or nuts, for example, horse-chestnuts, oaks, hickories, walnuts, maples, elms;
9. To get young evergreen or other tree seedlings from the woods, and to prepare them on nursery lines for home planting;
10. To compare yields from same weights of large and of small seed;
11. To produce one's own mangel, turnip, or carrot seed;
12. To begin the selection of the best hills of potatoes, best heads of corn, best heads of oats, and to grow crops from these;

13. To make a complete valuation of the farm and all its equipment—buildings, fences, drains, machinery, live stock, feed, fields, and orchards;
14. To estimate the cost of producing the different crops grown, keeping accounts for each field;
15. To estimate the cost of producing milk and butter.

HOME AND SCHOOL GARDENS SUPPLEMENTARY

In many cases the home garden may be made supplementary to the school garden and, where this can be accomplished, much good will result, as it will link up the home and the school in such a way as to prove of benefit to both. If seed selection is a part of the work of the school, the investigations may be continued in the home plot.

EXPERIMENTAL WORK

EXPERIMENTAL PROBLEMS

In the Fourth Form especially, some individual experimental work should be undertaken. This is one of the chief features of school garden work, because it develops the experimental faculty, without which farming becomes uninteresting and mere drudgery. Some problems should be attempted each year, no matter whether similar problems have already been worked out elsewhere or not.

DEFINITE OBJECT IN VIEW

In arranging any experimental work it is necessary to have but one definite object in view. Any definite experiment is a question put to nature which she is bound to answer. If a comparison is to be made with reference to one result, all other conditions must be similar.

EXPERIMENTS SUGGESTED AS SUITABLE FOR SCHOOL PLOTS

The following experiments are only suggestive and may be made the basis for a selection. As far as possible they should be worked out in the school garden, but, wherever any experiment can be continued in the home plot or garden, it would be very desirable to so continue it. There is no better "back to the land" stimulus than that created by a desire to work out a problem in which the pupil has become interested.

FERTILIZER TESTS

In all experiments with fertilizers in powder form, care should be taken not to apply the dressing too heavily. The formula advised by the dealer should be carefully observed. Where the plot contains a few square yards the amount may seem small, but in no case should it be very materially increased, unless for experiment, as many commercial fertilizers are quite injurious to plant roots when an overdose is given.

1. Make a comparison between two plots treated in exactly the same manner, excepting that commercial fertilizer was applied in one case and not in the other.

2. Make a comparison between a commercial fertilizer and barnyard manure.

3. Make a comparison between two plots similarly treated, except that to one plot was applied only half the amount of commercial fertilizer.

4. Make a comparison between two plots, one of which received a dressing of lime and the other a commercial fertilizer.

5. If a commercial fertilizer proves of value (which is not always the case) one year, compare the results the following year with an untreated plot.

SEED SELECTION

1. From a specially good type of oats or barley make a selection, and from the crop select again, keeping this continuous selection up from year to year. When sufficient selected seed of the type aimed at is obtained, it should be transferred to certain home plots and followed up.

2. Compare hand-picked seed with average seed. Use oats, barley, or buckwheat, though the experiment may be made with any seed.

VARIETY TESTS

1. Compare two varieties of oats or barley in regard to yield, strength of straw, and early maturing.

2. Introduce soy beans or cow peas to the school garden.

3. Introduce sweet clover as a fodder crop.

4. Estimate experimentally the value per acre of field beans. (Write for market price.)

5. Estimate the value per acre of sugar beets. (Write for market price.)

6. Compare, in regard to yield, pop-corn with sweet corn.

POTATO EXPERIMENTS

1. Make a comparison of crops raised (*a*) with a commercial fertilizer, (*b*) with no fertilizer, (*c*) with lime (3 tons per acre), (*d*) with wood ashes (3 tons per acre).

2. Compare potato crop (in hills), (*a*) when two beans are planted in the hill with potatoes, (*b*) without beans.

3. Compare results obtained from a plot sprayed with Bordeaux mixture and from an unsprayed plot.

4. Compare crop of early potatoes obtained from those started in the cold frame and crop obtained from those taken from the cellar.

SCHOOL PROGRESS CLUBS

In order to make the teaching and organization of Agricultural classes more effective in connecting the work of the school with the interests of the home and the community, associations called School Progress Clubs should be organized. The membership of such organizations should be composed of pupils, ex-pupils, teachers, and parents.

AIMS AND OBJECTS

1. To promote the cause of Agricultural Education by arranging Club projects bearing directly upon the work of the laboratory and the class-room. In this connection it may be useful occasionally to subdivide the general organization into canning clubs, corn clubs, etc.

2. To improve the school grounds and to exercise some general supervision over school gardens, flower-beds, gates, and fences. The management of Arbor Day improvements might properly, also, be undertaken.

3. To assist in the organization and management of the School Fair and, to a certain extent, to share in the inspection of the home plots.

4. To give some training and practice in leadership.

METHODS OF PROCEDURE

In organizing such a Club the ordinary methods of procedure should be followed, that is, the election of a president and other necessary officers. It happens quite frequently that honorary officers are elected, but this practice is rarely productive of good results. The officers should be chosen for their zeal and activity, and only those likely to make an effort to become leaders should be appointed. As has already been mentioned, one of the functions of the School Progress Clubs is to develop leadership at a time in the life of the pupil when there is an opportunity for such training under the direction of a teacher.

Wherever possible, the officers of the Club should also be officers of the School Fair Association, in order to link up, as closely as possible with such Associations, the teaching of Agriculture and the work of the school gardens and home projects.

SAMPLE PROBLEM

The following problem suitable to a rural school is given, as suggesting the method to be employed in carrying out the idea:

POULTRY CLUB

As stated above, the Poultry Club should be an organization under the School Progress Club and should contain as members only those undertaking poultry work.

1. *April 15th*: The organization meeting should ordinarily be held about the middle of April. At this meeting the number of members will be decided upon, and the scope of the work, the duties to be performed by the individuals, and the character of notes to be made will be explained by the teacher.

2. *May 1st*: Another meeting should be held when the eggs are distributed. At this meeting the precautions regarding kinds of nests for the setting hen, the candling of eggs for fertility, and the care of the hen during incubation should be discussed.

3. *May 18th*: The third meeting might be held about two or three days before the chicks are expected to appear. Discuss with the members of the Club the management of the young chicks and, if at all practicable, the members should make their own coops.

4. *June 1st*: Discussion of methods of feeding; and reporting of results. The care of chickens at large and within wire netting should also be discussed.

5. *June 25th*: A general survey of the Problem from its commencement should be made. At this meeting the plans for exhibits should be arranged; the kind of coops for exhibition considered, and entries for the autumn exhibit made. If there is a School Fair, the final meeting might be in connection with this. If there is no School Fair, a meeting should be arranged about September 20th, when the poultry should be judged by an expert and the prizes awarded.

Prizes should be awarded, (*a*) for the best fowls, (*b*) for the best notes on the project, and (*c*) for the best coop made by the members exhibiting fowls.

SCHOOL FAIRS

The organization known as School Fairs is under the direct charge of the District Representative of the Department of Agriculture of the County, in co-operation with the Public School Inspector. The chief object of this organization is to arouse an interest in experimental work at the homes of the pupils, and to educate the country boys and girls along practical lines, not only in home garden work, but also in business methods as well.

THE TOWNSHIP AS THE UNIT

As the organization develops, it assumes usually the township as the unit, with a centre at some convenient point. At this centre the schools concerned assemble their produce, which may be from home gardens or plots, for exhibition, but it is intended, as the school gardens progress, to have the competition in respect to products from these gardens an important feature of the Fair. As it is at present, there is some danger of having on exhibition, under the name of the pupil, material produced in the home garden which represents the work of an industrious parent or friend, rather than that of the pupil. This tendency toward exhibiting what is not the product of the pupil's own effort is not so common as some suppose, and it will gradually become less as the school gardens become more general, since the teacher will then be a directing force throughout the whole season during which the crop is grown.

ATTITUDE OF THE INSPECTOR

The Public School Inspector will, it is understood, supervise the home projects by questioning the pupils and teacher, on the occasion of his visits, concerning the problems undertaken, and by giving advice and assistance with reference to the Fair. As the Inspector is responsible for the schools under his charge, he is the person upon whom the Department of Education relies to see that the Fair is made, as much as possible, an educational institution;

and he will assist and guide the District Representative toward that end.

LIVE STOCK AS A PROJECT

The live stock exhibits in a School Fair may, if properly managed, be made an important feature. A colt or calf, halter-broken, groomed, and handled by a pupil is always interesting and instructive. Exhibits of poultry, hatched and raised under the charge of a pupil, especially if eggs are obtained from some source which would indicate uniformity as to quality and breed, should form a very important feature of the Fair.

UNIFORMITY DESIRABLE

In order to secure uniformity as a basis of competition, it is necessary to see that the pupils have seed of the same kind. When this is the case, the competition is fair and judging is made easier. In awarding prizes it is, as a rule, better to have the prizes small and numerous than to have a few of greater value.

SCHOOL FAIRS NOT OBLIGATORY

School Fairs are not obligatory, but trustees and teachers are invited to co-operate with the Inspector and the District Representative in managing and financing the organization. The details of arrangement may be made to suit those concerned.

THE BURDEN OF MANAGEMENT

Where there is no District Representative the burden of management will fall upon the individual schools, and especially upon the Inspector and the teacher. In such cases each township should have either a trustees' association or a township teachers' association, or, better still, an association of both combined. This would facilitate matters very materially, not only in connection with the work of the School Fair, but also in promoting rural improvement and uniformity in all business connected with the school.

It is intended that the school fair movement shall be a school institution, and that it shall not be absorbed by either the county fair or the township fair.

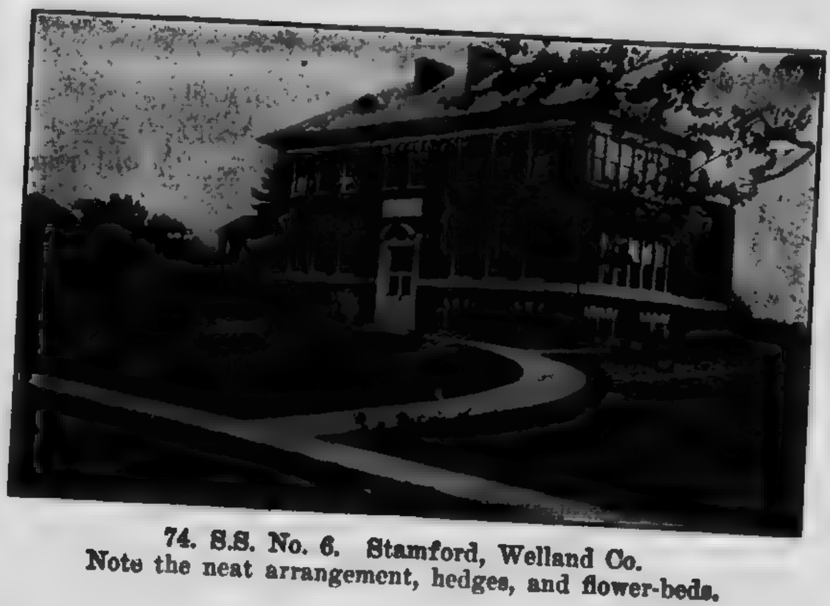
BEAUTIFYING THE SCHOOL GROUNDS

ATTENTION GIVEN TO THE GROUNDS AND BUILDINGS

One of the requirements in connection with the teaching of Agriculture in the rural schools, is that attention shall be given to the grounds and buildings. Many country schools present a neglected appearance and are anything but beautiful and home-like. The responsibility for this does not lie altogether at the teacher's door; yet, if the teacher assumes a leading part, parents and trustees are usually willing at least to give encouragement, and sometimes to lend a hand. Pupils are always ready to give assistance in this matter, especially if time is taken from the regular school programme; and it would certainly be wise to take time to engage in such an important educational work.

THE USE OF TREES

Trees are, without doubt, the most important feature in a landscape and, therefore, if there are no trees already on the grounds, they should be planted under the direction of the teacher. The Department of Education has set apart Arbor Day—the first Friday in May—as a day to be devoted to the improvement of school grounds in general, and to tree-planting in particular. Where the school is situated near a wood lot, trees may be dug up there and removed to the school grounds, but this digging up is a difficult matter and requires considerable physical strength; and it might be as well to secure the services of an able-bodied man for this part of the work.



74. S.S. No. 6. Stamford, Welland Co.
Note the neat arrangement, hedges, and flower-beds.

PLANTING TREES

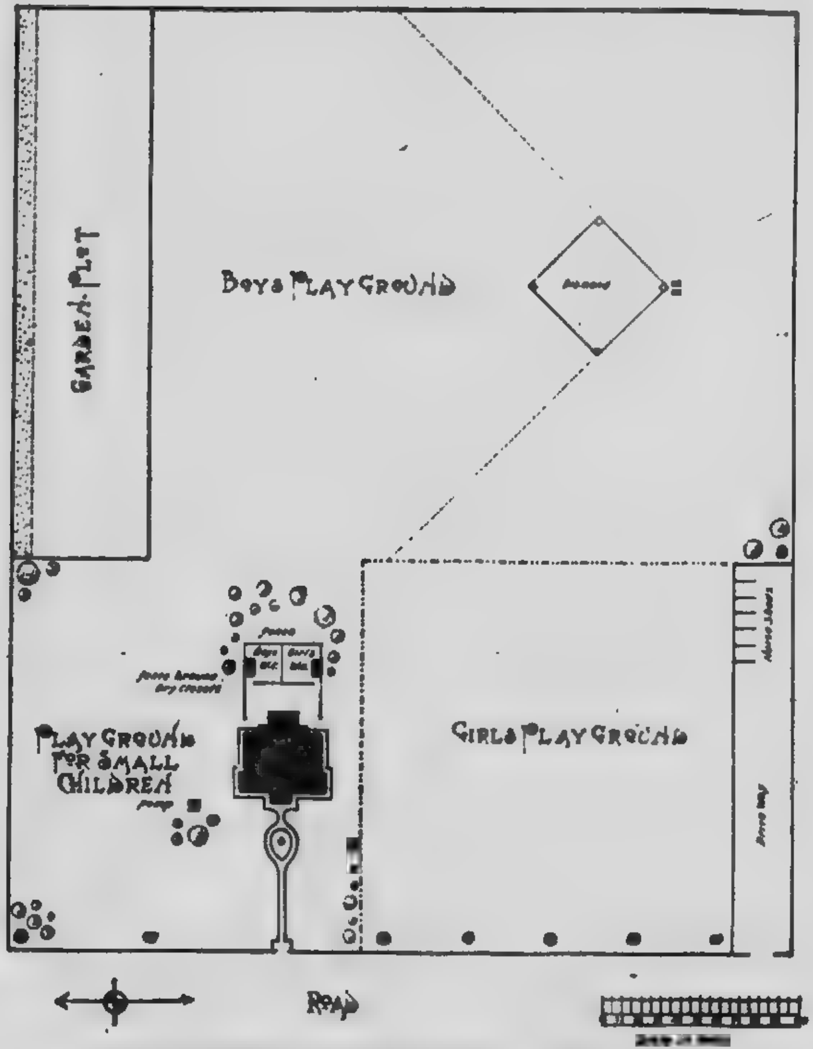
Too great care cannot be taken in removing trees from the ground. The bark must not be injured, the roots should be cut off as cleanly as possible—not haggled—and some soil should be left adhering to them. The tree should be pruned back, when lying on the ground, each branch being removed by a sharp, clean cut.

PLANTING TREES IN SUMMER

If trees are to be transplanted in the summer when in full leaf, it is best to prune back before digging them up, as this will prevent loss of water by transpiration during the time between digging up and re-setting. It will assist the tree to recover if a cap made of burlap be placed about the tree-top, in order to prevent loss of water during the first few days of its life in the new position. The tree ought to be planted slightly deeper in its new abode than it was in the old, thus providing a little extra soil to act as a ballast against injury by wind. A few stones placed on the ground near the trunk will assist, not only in keeping the roots firm, but also in acting as a mulch to prevent too great a loss of water by evaporation from the soil near the roots.

KINDS OF TREES

Where it is not possible to secure trees from the woods in the neighbourhood, it is necessary to buy them from a nursery. In such cases attention has to be given only to the planting. The kinds of trees to be used will depend upon the neighbourhood and the soil conditions; but as a general rule, for deciduous trees, the American elm, basswood, and soft maple are preferable, as they are easily and rapidly grown. For evergreens, the Norway spruce and the Colorado blue spruce are available and grow readily in Ontario. Our own native black spruce and white spruce are so subject to gall-louse that they are difficult to raise. The Manitoba maple (box elder) is easily and rapidly grown; but it is not a very good tree, and it is short-lived. There is no good reason why the sweet chestnut, shell-bark hickory, and black walnut should not be used here and there. They are very valuable trees and are becoming scarce in Ontario. For variety, the paper birch, white pine, and white ash make a good appearance. The trees to be avoided are poplars and willows (except for a wet, boggy place). Oaks, beeches, and ironwoods grow too



74 (a). Plan for school grounds of three acres

slowly. The sugar maple is difficult to grow now, on account of the borers which work around the trunk near the root; but this is one of the most magnificent trees and was grown with great success when borers were not so common as they now are.

USE OF SHRUBS

Too little use has been made of shrubs for decorating school premises, and frequently, when they have been employed, little attention has been given to placing them in suitable positions. If shrubs are properly placed, they may be made very effective in improving the grounds.

KINDS OF SHRUBS

The kinds of shrubs to be used will depend largely upon local conditions with regard to soil, climate, and the general plan of the school grounds. For damp ground there is no better shrub than the red osier dogwood. In fact, this shrub, a native of our swamps, will do well on almost any kind of soil. The swamp bush-honeysuckle is a fast grower and does well in clay land; so do the black elderberry and several species of viburnum. The hazel-nut which can be had from the woods makes a good, dense shrub, and the wild rose should also be taken into consideration. All the above mentioned are natives of Ontario and make first-class decorative shrubbery. Of course, there are many other beautiful shrubs which have been introduced from foreign countries and which do well here, but a strong plea is made for our own shrubs, highly prized in other countries, but neglected in Ontario. The common barberry is an interesting shrub, but it should never be used, on account of the part it plays in the promotion of wheat rust.

In arranging for the location in which to plant the shrubbery, the whole landscape has to be considered. As a general rule shrubs should be used in corners, for shields in front of outhouses, or for other places which should be shielded. In no case should a shrub be placed in the middle of an open space in a lawn or a yard.

The lilac has long been a favourite and may be used where a high shrub is required. The shad bush or juneberry is also a favourite high shrub. The common arbor vitae, or cedar, of our swamps, makes an excellent evergreen shrub and is of the greatest service as a shield for both winter and summer, growing readily with moderate care. (Write to the instructor of Landscape Gardening, Ontario Agricultural College, Guelph.)

PLANT DISEASES

PLANTS, AS WELL AS ANIMALS, SUBJECT TO DISEASE

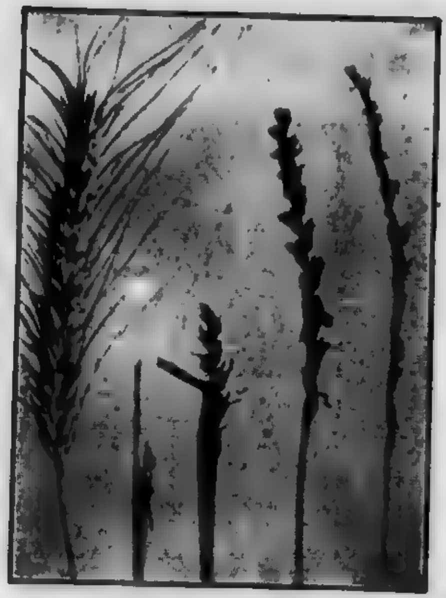
Plants, as well as animals, are subject to various forms of disease due to a great variety of causes. The chief agents in producing diseases of plants are small forms of plant life known as fungus parasites. These parasites are sometimes called fungus diseases, which include those produced by bacteria. Wheat rust, corn smut, potato blight, black knot, and apple rot are examples of fungus diseases which are fairly common.

DAMAGE BY FUNGUS DISEASES

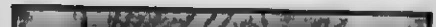
The damage caused by the various fungus diseases in one year in Ontario amounts to many millions of dollars. In Saskatchewan, in 1916, the wheat rust alone did damage to the extent of many millions. The potato blight not

75. Apple scab on fruit

75 (*a*). Apple scab on leaves

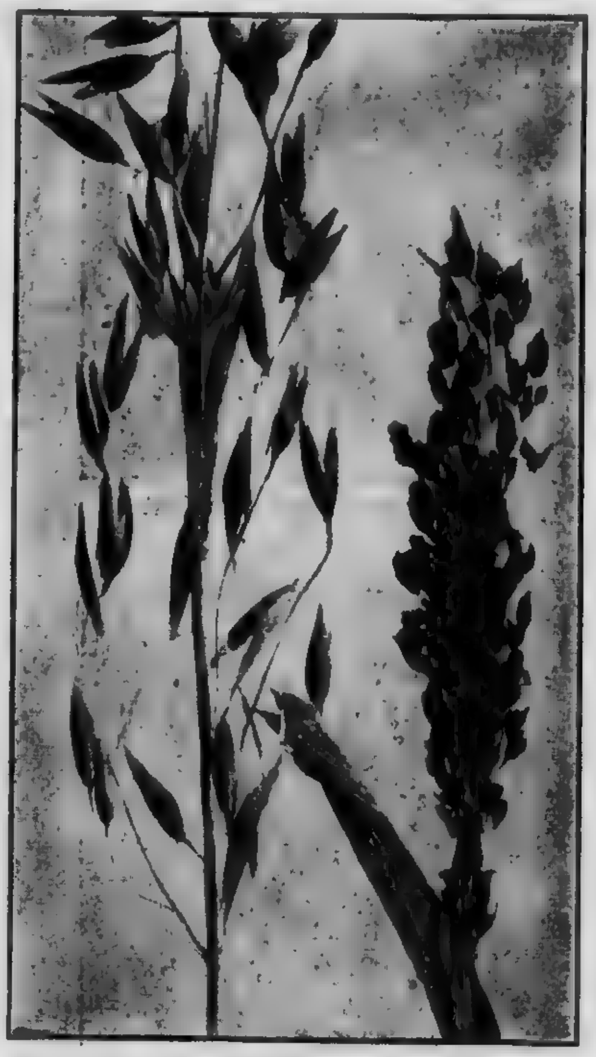


76. Loose smut of wheat



76 (a). Stinking smut of wheat

infrequently causes untold injury to the potato crop. The famine in Ireland, caused by the failure of the potato crop in 1854, was due to this disease. Apple scab is a serious menace to the apple growers of Ontario. Pear blight has,



77. Oat smut

in certain localities, put an end to pear growing. We might continue the enumeration, but the foregoing instances show the importance of a knowledge of the life histories of such diseases.

78. Corn smut

REMEDIES

Certain fungus pests may be checked by spraying with fungicides which are described under the head of Spraying, page 164. Bordeaux mixture is the oldest and probably the best known of the fungicides. But the application of a fungicide is not practicable in many cases. For example, take the case of wheat rust. It would be impossible to apply a fungicide to the crop of wheat already headed out. Neither could a fungicide be applied to a crop of oats to kill smut. Potato scab works on the tuber under ground, consequently a fungicide cannot be applied to the growing crop.

As a general rule the following may be taken as a guide in combating fungus diseases:

GENERAL LEAF DISEASES.—Bordeaux mixture as a spray.

ROOT DISEASES.—Rotation of crops and drainage.

TWIG OR BRANCH DISEASES.—Pruning and strong fungicides.

INSECT PESTS

DESTRUCTION BY INSECTS

The destruction caused in Canada by insects to the various useful plants and animals is estimated to be annually about $75,000,000. Insects infest forest trees, cereals, root crops, poultry, farm animals, clothing, truck crops, fruit, etc. The estimates of losses caused are, of course, largely comparative, yet there is an enormous amount of loss which is only too real. Where this is taken into consideration, the matter of controlling insects becomes a subject of the utmost importance. The insect puts a heavy tax on farm products, and the farmer is endeavouring, by a constant warfare against these enemies, to lighten this tax as much as possible.

LIFE HISTORIES

To combat insect pests successfully it is necessary to know something of their life habits. Generally speaking, we may say that there are four distinct stages in the course of the life of an insect—egg, larva, pupa, and adult. As a rule the pupa stage is a dormant or resting-stage, during which the insect eats nothing. The larval stage is the time when most insects do damage by eating.

From Entomological Branch, Dept. of Agriculture, Ottawa

79. San José Scale

REMEDIES

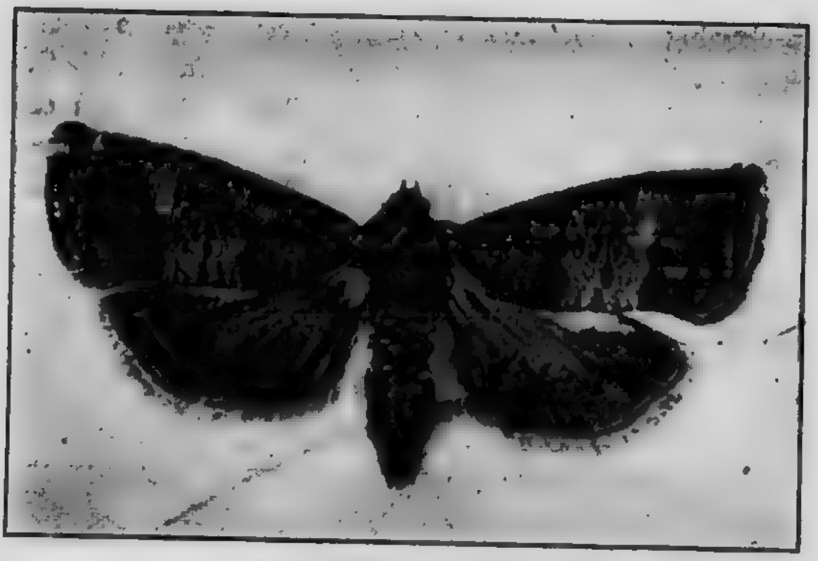
When we know the life history and the habits of an insect, the battle is half won. The insects that chew the leaves of plants can be destroyed by applying a poison to the leaves. Those which suck out material from the plant tissues by penetrating the surface layers are killed by applying some material which corrodes or otherwise destroys the body of the insect by contact. Insecticides are, therefore, of two classes—those which poison and those which kill by contact. Arsenate of lead is an example of the former, and whale-oil soap and lime-sulphur are examples of the latter.

SPRAYING

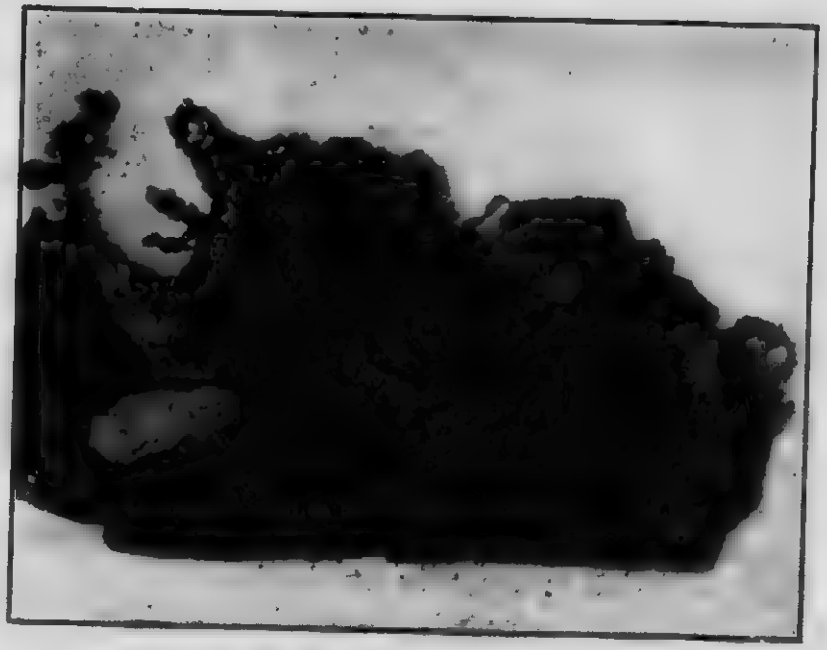
FUNGICIDES AND INSECTICIDES

As has been pointed out, there are two general classes of injuries to plants produced by parasites—(*a*) fungus injury and (*b*) insect injury. Fungi (plural of fungus) are plants of exceedingly small size, especially those which are parasites upon other plants. Examples of these are apple scab, wheat rust, corn smut, potato blight, etc. The spray mixture used to check these pests, whether in liquid or dust form, is called a *fungicide*. Examples of fungicides are Bordeaux mixture, copper sulphate, lime-sulphur.

Injury by insects may be brought about by loss of material, due to the fact that the surfaces of leaves or other parts of the plants are chewed off and eaten, or by the loss of juice sucked out from beneath the surface by specially developed organs of the insect. Insects may be classified



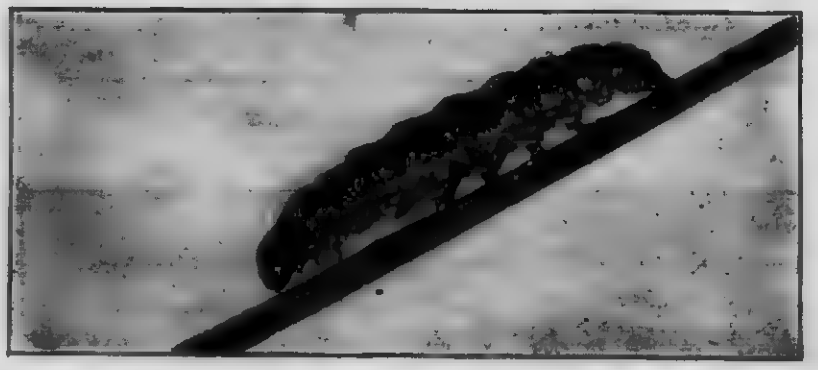
79 (*a*). Codling moth—adult



79 (*b*). Codling moth—pupa

as chewing insects and sucking insects. The material used, whether liquid or dust, to check the ravages of both classes of insects, is called an *insecticide*. Examples of insecticides are Paris green, arsenate of lead, hellebore, lime-sulphur, kerosene emulsion.

It is quite clear that in order to kill a chewing insect it would require the use of a spray mixture different from that required to kill a sucking insect. Examples of sucking insects are—San José scale, oyster-shell scale, and aphis (plant lice); and of chewing insects—potato beetle, codling-moth, and tent caterpillar.



78 (*c*). Codling moth—larva

In order to destroy chewing insects it is necessary to use a poison which is placed upon the leaves of the plants to be protected. The poison is eaten with the leaves, and the insect is killed. Sucking insects are killed by the effect of the material on the body of the insect, either by corroding the surface or by filling up the breathing pores of its body.

Some insecticides may also act as fungicides, and thus perform a double function.

POISONS

Paris-green spray is made by mixing two ounces of the powder with ten gallons of water. Arsenate of lead, which generally comes in the form of a thick paste, is prepared by mixing one pound with twenty gallons of water. These are both good insecticides, but the latter has an advantage over Paris green, as it is not so readily washed off by rain.

THE BEST KNOWN FUNGICIDES

Bordeaux mixture is the oldest and best fungicide known, and is made as follows: Dissolve four pounds of copper sulphate (blue-stone) in a pail (wooden) of water, and four pounds of fresh quick-lime in another pail of water; then mix the two, as indicated on page 178. Bordeaux mixture should always be used up completely, as it undergoes considerable change as time goes on and has a very corrosive action on such metals as iron, zinc, and lead.

LIME-SULPHUR

Lime-sulphur is rather difficult to make, and therefore the stock solution should be obtained from a dealer. This stock solution may be diluted as required. As its name implies, it is made by boiling together, in proper proportions and under proper conditions, quick-lime and flowers of sulphur. Its chief value as a spray lies in the fact that it is exceedingly effective for the scale insects (San José scale and oyster-shell scale). It has also, when applied strong, a fungicidal value, but it is not so effective for this purpose as many people suppose, when it is applied in dilute form. In reality the fungicide is the sulphur of the mixture which results from the chemical decomposition of the lime-sulphur into lime and sulphur. Sulphur dust in very fine powder is probably an equally effective fungicide.

SPECIFIC REMEDIES

In the following table is given the specific spray mixture or liquid for certain of the commoner insects and fungi:

INSECT PESTS—

Potato beetle, arsenate of lead, Paris green,
Codling-moth, " " " "
Tent caterpillar, " " " "
Cabbage worm, hellebore, arsenate of lead,
San José scale, lime-sulphur,
Bud moth, arsenate of lead.

FUNGUS PESTS—

Apple scab, Bordeaux mixture, lime-sulphur,
Potato blight, " "
Grape mildew, " "
Peach leaf curl, " " lime-sulphur,
Oat smut, formalin,
Wheat smut, " (closed smut or stinking smut),
Potato scab, "

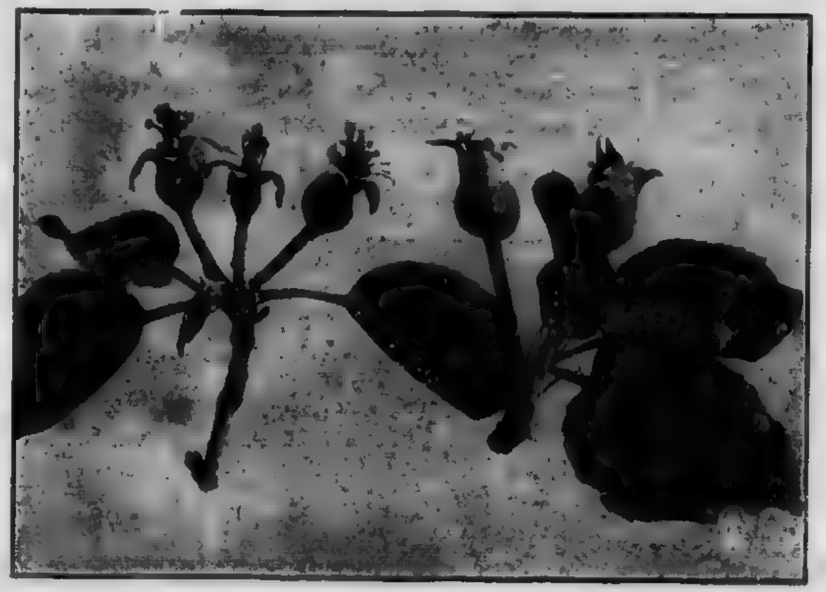
From Entomological Branch, Dept. of Agriculture, Ottawa

80. San José scale, highly magnified

From Entomological Branch, Dept. of Agriculture, Ottawa

81. Oyster-shell scale

There is a considerable number of fungus diseases to which the spray remedy will not directly apply. Such diseases as wheat rust, black knot, and pear blight belong to this class and require special treatment. Neither is spraying a remedy for all insect pests, as there are many insects whose life habits are quite different from those of the leaf-eaters. Wire-worms, cut-worms, army-worms, pea-weevil, etc., are very difficult to control; and no general remedy can be given for all. A knowledge of the life history of each is necessary, in order that the proper treatment may be applied.



82. Left—Appearance of apple at time for third application of spray. Right—too late

SPRAY CALENDAR

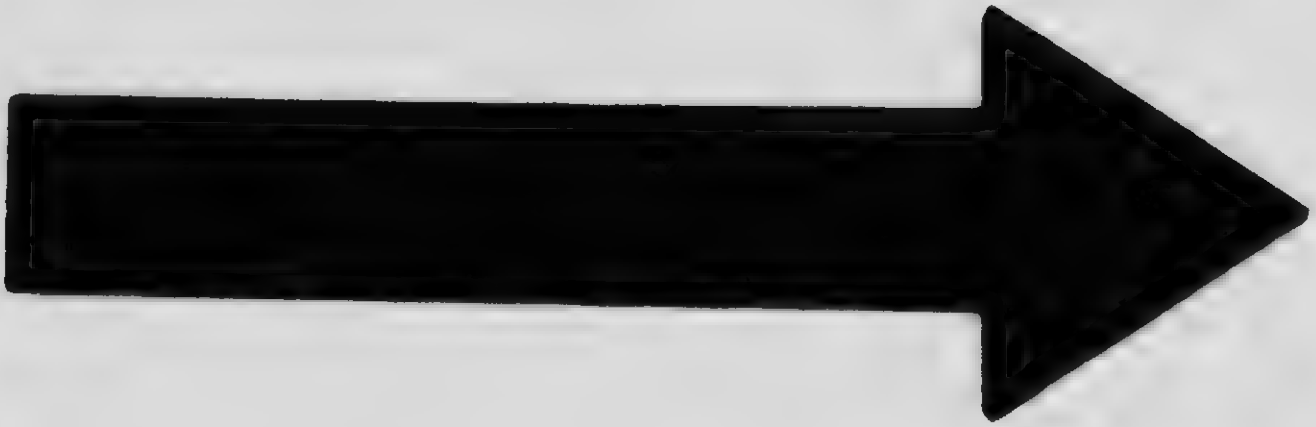
By L. Caesar, O.A.C., Guelph

PLANT AND PESTS	1ST APPLICATION	2ND APPLICATION	3RD APPLICATION	REMARKS
APPLE Scab or black spot, canker, leaf spot, codling-moth, and other biting insects, scale insects, blister-mite, and aphids. (Consult Bulletins 187, 194, 198, and 219.)	Either before or soon after the leaf-buds burst, preferably the latter. Use A1 or B. For San José scale prune severely, scrape off loose bark, and drench the whole tree, paying special attention to outer twigs.	Just before the blossoms open. Use A2 or D, with 2 or 3 lb. arsenate of lead to each 40 gal. of the liquid.	Immediately after the blossoms have all, or nearly all, fallen, and before the calyces close. Use A3 or D, with 2 lb. arsenate of lead to each 40 gal. This is the application for codling-moth.	For scab, a 4th application about 10 days after the 3rd is necessary if June is wet, also an intermediate one between the 2nd and 3rd with A3, *without any poison*, if the interval, owing to cool, damp weather, threatens to be long. Spraying with the weaker A3 early in August is an insurance against sooty fungus and late scab. If aphids are annually troublesome, delay 1st application till buds begin to burst, then add black leaf 40 or nicotine-sulphate 40% to A1 or B and cover every bud. For cankers cut out diseased bark, disinfect, and cover with white-lead paint free from turpentine. For blight on young trees keep suckers rubbed off trunk and main branches and cut out promptly any diseased branches or twigs well below the diseased bark. Always disinfect both cuts and tools with corrosive sublimate (1 to 1,000).

SPRAY CALENDAR—*Continued*

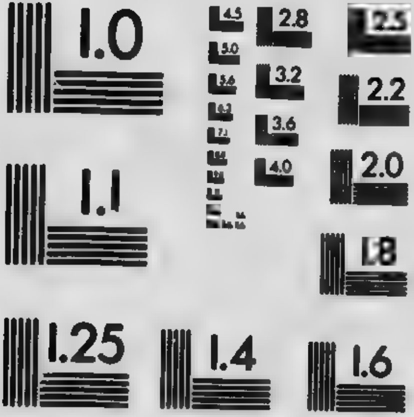
PLANT AND PESTS	1ST APPLICATION	2ND APPLICATION	3RD APPLICATION	REMARKS
PEAR Scab or cracking, blight, codling-moth, other biting insects, scale insects, blister-mite, psylla, and slug. (Consult Bulletins 176, 187, and 219.)	Shortly before or just after the bud bursts. Use A1 or B. For San José scale see above under Apple.	Just before the blossoms open. Use A2 or D, with 2 or 3 lb. arsenate of lead to 40 gal. of liquid.	Just after blossoms have fallen. Use A3 or D, with 2 lb. arsenate of lead to 40 gal.	Pears subject to scab should always receive a 4th application 10 days later than 3rd with same mixture. For blight cut out carefully in winter all blighted branches and twigs, cutting a foot or more below the diseased part. Also remove and burn trees too severely blighted to save. Throughout growing season watch for and remove promptly in the same way all blighted twigs or branches. Disinfect at once tools and all cuts with corrosive sublimate (1 to 1,000). For psylla delay 1st spraying with A1 or B until leaf-buds have burst and add black leaf 40 or nicotine-sulphate 40% to codling-moth spray if necessary. Arsenate of lead will kill slugs (3 lbs. to 40 gal.).
PLUM AND CHERRY Black knot, brown rot, leaf blight, or shot-hole fungus,	Just before or as the buds are bursting. Use A1 or B. For San José scale	Just after fruit is set. Use A2 or D, with 3 lb. arsenate of lead to 40 gal.	About two weeks later. Use A3 or D, with 3 lb. arsenate of lead to 40	For cherry fruit-flies (the cause of the little white headless maggots in cherries) use 3 lb. arsenate of lead to 40 gal. of water. Apply to all cherry trees just as Early Richmonds are getting a reddish blush, and again to only Montmorency and late varieties about 10 or 12 days later. For leaf-spot give a 4th application with same mixture as 3rd just after cherries are picked. Cut out and burn all black knots in winter

curculio, slug, aphids, and cherry fruit-flies. (Consult Bulletins 219, 226, 227, and 230.)	see above under Apple.		gal.	and whenever seen in summer For slugs see under Pear above. For aphids on sweet cherries postpone the 1st application until the buds are just bursting, and then add nicotine-sulphate 40% or black leaf 40. Good pruning with resulting increase of sunlight and air circulation help against brown rot.
PEACH Leaf-curl, scab, or black spot, yellows, little peach, curculio, borer, San José scale, shot-hole borer. (Consult Bulletin 241.)	Before the buds begin to swell. (All must be done before any sign of bursting of buds.) Use A1 or B. This is usually the only spraying peach-trees receive.	Soon after fruit is set. Use 2 or 3 lb. arsenate of lead and 1 or 2 lb. freshly slaked lime to 40 gal. water for curculio. Omit if curculio is not troublesome.	About [illegible] month after fruit is set. Use C if troubled by brown rot, or dust with sulphur. Good pruning and thinning the fruit help to control this disease.	If brown rot is likely to be troublesome use C again about one month before fruit ripens, or dust with sulphur. Destroy mummied fruit in autumn. Remove at once and burn any tree attacked by yellows or little peach, and also all suspected trees. Dig out borers at base of tree with knife in May and again in October. For shot-hole borer cut down and burn before April all dead or dying trees or branches, and leave no brush heaps near orchard.
GRAPES Black rot, powdery mildew, downy mildew, anthracnose, flea-beetle, leaf-hopper. (Consult Bulletin 237.)	When 3rd leaf is appearing use D.	Just after the fruit has set use D.		Spray again whenever wet weather threatens. It should always be done *before*, not *after* rain. At *first sign of powdery mildew* dust with sulphur or spray with C. For flea-beetles use poison whenever they appear. For leaf-hoppers or "thrips" use black leaf 40 or nicotine-sulphate 40%, or whale-oil soap in July to destroy nymphs. Clean cultivation is very important and destruction of all old mummied grapes and prunings.



MICROCOPY RESOLUTION TEST CHART

(ANSI and ISO TEST CHART No. 2)



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SPRAY CALENDAR—*Continued*

PLANT AND PESTS	1ST APPLICATION	2ND APPLICATION	3RD APPLICATION	REMARKS
CURRANT AND GOOSEBERRY Mildew, leaf-spot, currant worm, aphids, red spider, and San José scale. (Consult Bulletin 222.)	Shortly before or as buds burst use A1 or B. For San José scale, prune and spray heavily.	Just before blossoms appear, use A2, with 2 lb. arsenate of lead to 40 gal.	Just after fruit is formed use A2, with 2 lb. arsenate of lead to each 40 gal.	For worms when fruit is ripening, use hellebore. Look for aphids just as buds burst; if present spray with black leaf 40 or kerosene emulsion or whale-oil soap, or postpone 1st application till then and add black leaf 40 or nicotine-sulphate 40% to A1 or B.
RASPBERRY AND BLACKBERRY Anthracnose, red rust, crown gall. (Consult Bulletin 210.)	Before growth begins use D. Omit if not troubled by anthracnose.	When shoots are 6 or 8 inches high use D. Omit if no anthracnose.	If caterpillars are attacking the leaves use 2 lb. arsenate of lead to 40 gal. water if no danger of poisoning the fruit; otherwise use 1 oz. hellebore to 1 gal. water.	If anthracnose is very severe, set out new plantation of healthy shoots. If disease begins, cut out old canes as soon as fruit is picked, also badly attacked new ones, and burn. For red rust remove and burn plants at once. No other remedy. For crown gall set out plants in fresh soil, rejecting any plant with a gall on root or crown.
STRAWBERRY Leaf-spot and white grub. (Consult Bulletin 210.)	For leaf spot set out only healthy plants with no sign of disease. First season spray with D before blossoms open and keep plants covered with mixture throughout the season. Second year spray before blossoming with D, and again soon after picking; or mow and burn over after picking. Don't take more than two crops off. Plough down at once after second crop. For white grubs dig out as soon as injury is noticed; do not plant on land broken up from old meadow or pasture for at least three years after breaking. Mowing, burning over, and ploughing down just after the second crop is a great aid against pests.			
BEAN Anthracnose and bacteriosis. (Consult Bulletin 171.)	Get seeds from pods showing no signs of disease. Do not work among the plants if they are wet with rain or dew. Spraying scarcely pays as a rule. Some strains seem to be nearly immune to anthracnose.			

CABBAGE AND TURNIP Flea-beetles, caterpillars, root maggots, aphids. (Bulletin 171)	For flea-beetle on turnip sow after June 21st, or dust plants as soon as they appear above ground with Paris green, or spray with Bordeaux and a poison and a sticker. Repeat in two days. For caterpillars dust with Paris green until heads begin to form on cabbage and cauliflower, then spray with fresh pyrethrum, 1 ounce to 1 gallon water. For root maggots use *medium thick tarred felt-paper disks*, putting on as soon as plants are set out, or set out plants after July 1st. For aphids use kerosene emulsion as soon as they appear, or 1 lb. common laundry soap dissolved in 4 gallons water. Hit them hard with the spray.
POTATO Tip burn, early blight, late blight, scab, Colorado beetle, flea-beetle. (Bulletin 171)	Keep foliage covered with D from time plants are about 5 inches high. Take special precautions to see this is well done if weather is at all damp after about 15th July, as late blight begins about this time. Add a poison to each application when necessary. For scab, soak tubers before cutting for 2 hours in 1 pint of formalin to 30 gallons of water. Spread out on grass to dry. Wash all boxes, bags, or other vessels to be used in same liquid. Plant none but perfectly healthy tubers.
TOMATO Leaf blight, black rot, flea-beetle. (Bulletin 171)	Spray plants in seed-bed with D. Keep foliage in field covered with D until danger of staining fruit. Add a poison if necessary for flea-beetles.
ASPARAGUS Rust, beetles. (Bulletin 171)	For rust, let no plants, not even wild ones, mature during cutting season. Late in autumn, when growth is about over, cut and burn old plants. For beetles let poultry run in the plantation. After cutting season is over spray with arsenate of lead; repeat in two weeks. May add sticker and a little lime.

Note.—A1=Concentrated lime-sulphur strength 1.030 specific gravity (1.035 for San José scale) (1.030=1 gal. commercial to 9 gal. water, and 1.035=1 gal. commercial to 7 gal. water).

A2=Concentrated lime-sulphur strength 1.010 or 1.009 specific gravity=1 gal. commercial to from 30 to 35 gal. water.

A3=Concentrated lime-sulphur strength 1.009 or 1.008 specific gravity=1 gal. commercial to from 33 to 40 gal. water.

B =The old home-boiled lime-sulphur, 20.15.40 formula.

C =Self-boiled lime-sulphur.

D =Bordeaux mixture, 4.4.40 formula.

FORMULAE FOR INSECTICIDES

(For biting insects only)

1. Arsenate of Lead (paste). 2 or 3 lb. to 40 gal. liquid spray; 3½ lb. for potato beetles. Dry arsenate of lead requires only half these strengths.

2. Paris Green.—(*a*) ¼ to ½ lb. to 40 gal.; 1 lb. for potato beetles. If used with water alone, add 1 to 2 lb. fresh lime; (*b*) 1 lb. mixed with 50 lb. land plaster, air-slaked lime, or some similar substance, for dusting on plants.

Note.—With Bordeaux, 1 or 2 above may be used; with lime-sulphur only 1; the other causes burning.

3. Poison Bran Mixture for Grasshoppers.—

Bran	20 lb.
Paris green	1 lb.
Molasses	½ gal.
Water	about 2 gal.
Lemons	2 or 3 fruits

Mix thoroughly the bran and Paris green in any large receptacle the night before using. In the morning squeeze the juice of the lemons into the water, run the pulp and rind through a meat chopper, add this and also molasses to the water, stir well, then pour the liquid upon the poisoned bran, and mix so thoroughly that every part is moist and will fall like sawdust through the fingers. Apply in the morning between five and seven o'clock by scattering so thinly over the infested field, fence corners, and roadsides, that the above amount will cover four or five acres. Sometimes a second application about three days later is necessary. Use as soon as the pest is abundant. Do not look for results for two or three days.

This mixture applied in the evening will also kill cutworms and army-worms.

4. **White Hellebore.**—One oz. to 1 gal. water, or dust undiluted over the plants. Hellebore left exposed to the air is useless.

CONTACT POISONS

(Chiefly for sucking insects)

1. **Kerosene Emulsion.**—

Kerosene (Coal-oil)	2 gal.
Rain-water	1 gal.
Soap	½ lb.

Dissolve the soap in water by slicing and boiling; take from the fire, and while hot pour in the kerosene and churn vigorously for five minutes. For use dilute with 9 parts of water, so that the above 3 gal. of stock emulsion will make 30 gal. of spray mixture.

2. **Whale-oil Soap.**—For brown or black aphids, 1 lb. in 4 gal. rain-water. For green aphids, thrip, and leaf-hopper, 1 lb. in 6 gal. rain-water.

3. **Tobacco Water.**—Steep 1 lb. refuse tobacco in 1 gal. of water for 1 hour, make up for water that evaporates, or soak 1 lb. in 1 gal. water for 24 hours with occasional stirring.

4. **Black Leaf 40.**—Sold by Tobacco Product Co., Louisville, Kentucky. Directions on the cans. A little soap with it helps, but soap cannot be added if used with lime-sulphur. Nicotine-sulphate 40% is sold by Grasselli Chemical Co., Toronto.

5. **Pyrethrum** (or insect powder):

Pyrethrum powder	1 oz.
Water	1 to 2 gal.

Dry mixture. Mix thoroughly 1 part by weight of pyrethrum with 4 of cheap flour, and keep in air-tight vessel for 24 hours before dusting over plants.

Note.—Pyrethrum is useless if left exposed to the air.

6. **Lime-sulphur Wash.**—
(See under fungicides.)

FORMULAE FOR FUNGICIDES

Bordeaux Mixture.—

Copper-sulphate (blue-stone)	4 lb.
Unslaked lime	4 lb.
Water	40 gal.

Dissolve the copper-sulphate in a wooden or brass vessel with hot water, pour into a barrel, and add cold water to make 20 gal.; slake the lime, preferably with hot water; add cold water to make 20 gal. Stir both barrels well and pour lime into the copper-sulphate barrel. (Never mix concentrated milk of lime and copper-sulphate solutions.)

A stock solution of each may be made and kept indefinitely if not mixed: Dissolve 40 lb. copper-sulphate in 40 gal. of water by suspending just below the surface of the water in a coarse sack. Each gallon of the liquid will now contain 1 lb. copper-sulphate. Slake any desired quantity of lime and put into a box or barrel in a shaded place, or sunk in the ground. Keep covered with a small amount of water to exclude the air. Calculate how much is required for 4 lb. lime if well stirred.

To test Bordeaux mixture, let a drop of ferro-cyanide of potassium solution fall into a little of the mixture in a saucer. If this causes it to turn reddish brown, add more lime until no change takes place.

Lime-sulphur Wash.—

(1) **Home-boiled** (for use on dormant wood only).—

Fresh stone lime	20 lb.
Sulphur (flour or flowers)	15 lb.
Water	40 gal.

Slake 20 lb. of lime in about 15 gal. or more of boiling water, in a kettle or other boiling outfit. While slaking add the 15 lb. sulphur made into paste by the addition of a little water. Boil vigorously, with stirring, for 1 hour. Dilute to 40 gal. with cold or hot water. Strain and apply at once.

(2) Home-made Concentrated Lime-sulphur.—This may be used as a substitute for commercial lime-sulphur, but is only about ⅔ as strong as a rule.

Sulphur (a fine grade)	100 lb.
Fresh stone lime, high in percentage of calcium	50 lb.
Water	40 or 50 gal.

Put about 10 gal. water in the boiling outfit, start fire, add sulphur, stir to make paste and break lumps, then add remaining water, and when near boiling put in lime. Stir frequently while slaking and until all the sulphur and lime are dissolved. Add water from time to time to keep up to 40 or 50 gal. mark. Boil 1 hour, then strain through a screen of 20 meshes to one inch into storage barrels. Make enough at once for the season's work. Cover well to keep out air, or pour oil of any kind over the surface to a depth of ⅛ inch for the same purpose.

To determine how much to dilute for different applications, use an hydrometer with specific gravity readings, and apply the following rule:

Put the hydrometer in the clear liquid when it is cold and the sediment has all been settled for a day or two. Note the number to which it sinks. Suppose this is 1.240. The strength for use before the buds burst should be 1.030 or stronger. To determine how much to dilute a strength of 1.240 to get 1.030, divide the three figures to the right in 1.240 by 30, that is 240 divided by 30=8. This means that each gallon of such a wash must be diluted to 8 gal. with water to give us a strength of 1.030, the proper spring strength. For the second application 1.009 is about the right strength. To get it divide the 240 by 9, which gives 26⅔, or roughly speaking 27. This means that each gallon of a wash of the strength of 1.240 must be diluted to 26⅔ or 27 gal. to make the right strength for the second application. For the third application and any later ones 1.008 is about the right strength, and to get this we proceed in the same way and divide 240 by 8=30, so that each gallon must be diluted to 30 with water for this application. If the strength of the concentrated were 1.212 or any other number, you would, in the same way, divide the three figures to the right by 30, 9, and 8 respectively, to get the proper dilutions for each spraying.

Table for Changing Baumé Readings into their Equivalent Specific Gravity Readings

Baumé		Specific gravity	Baumé		Specific gravity
18	=	1.141	27	=	1.230
19	=	1.150	28	=	1.240
20	=	1.159	29	=	1.250
21	=	1.168	30	=	1.260
22	=	1.178	31	=	1.271
23	=	1.188	32	=	1.282
24	=	1.198	33	=	1.293
25	=	1.208	34	=	1.305
26	=	1.219	35	=	.317

NOTE.—Commercial lime-sulphur should be tested with the hydrometer and diluted according to the same rules as the home-made concentrated form.

(3) Self-Boiled (chiefly for use on peach foliage).—

Fresh stone lime	8 lb.
Sulphur (flour or flowers)	8 lb.
Water	40 gal.

Best prepared in quantities of 24 lb. at a time to get sufficient heat. Place 24 lb. lime in a half barrel, add enough cold water to start it slaking well and to keep the sulphur off the bottom. Dust the 24 lb. sulphur over the lime, having first worked the sulphur through a screen to break the lumps, then add whatever further amount of water is necessary to complete the slaking. Stir well with a hoe, to prevent the lime caking on the bottom. As soon as the slaking is over, add enough cold water to cool the whole mass and prevent further combination. Strain into a spray tank. Keep well agitated while spraying.

Disinfectants (for pruning tools and for wounds on trees).—

(1) Corrosive sublimate, 1 part to 1,000 by weight= 1 tablet to 1 pint of water. Apply with a swab on end of a stick.

Caution.—Corrosive sublimate is a deadly poison to man or beast if taken internally. It will also corrode iron or metal, so use in a glass or wooden vessel, and be sure to wash these out very thoroughly when through using them.

(2) Lime-sulphur about twice spring strength, or blue-stone, 1 lb. dissolved in about 14 gal. water, may be used to disinfect wounds or cankers, but is not satisfactory in case of Pear blight.

STICKER

Resin	2 lb.
Sal Soda (crystals)	1 lb.
Water	1 gal.

Boil together till a clear brown colour, which takes from 1 to 1½ hours. Cook in an iron kettle in an open place. Add the above to 40 gal. Bordeaux for use on smooth foliage like onions, cabbages, or asparagus. If used with arsenate of lead or Paris green, add 1 to 2 lb. of fresh lime to every 40 gal. of spray.

NOTE: Good spraying pays well; poor spraying does not.

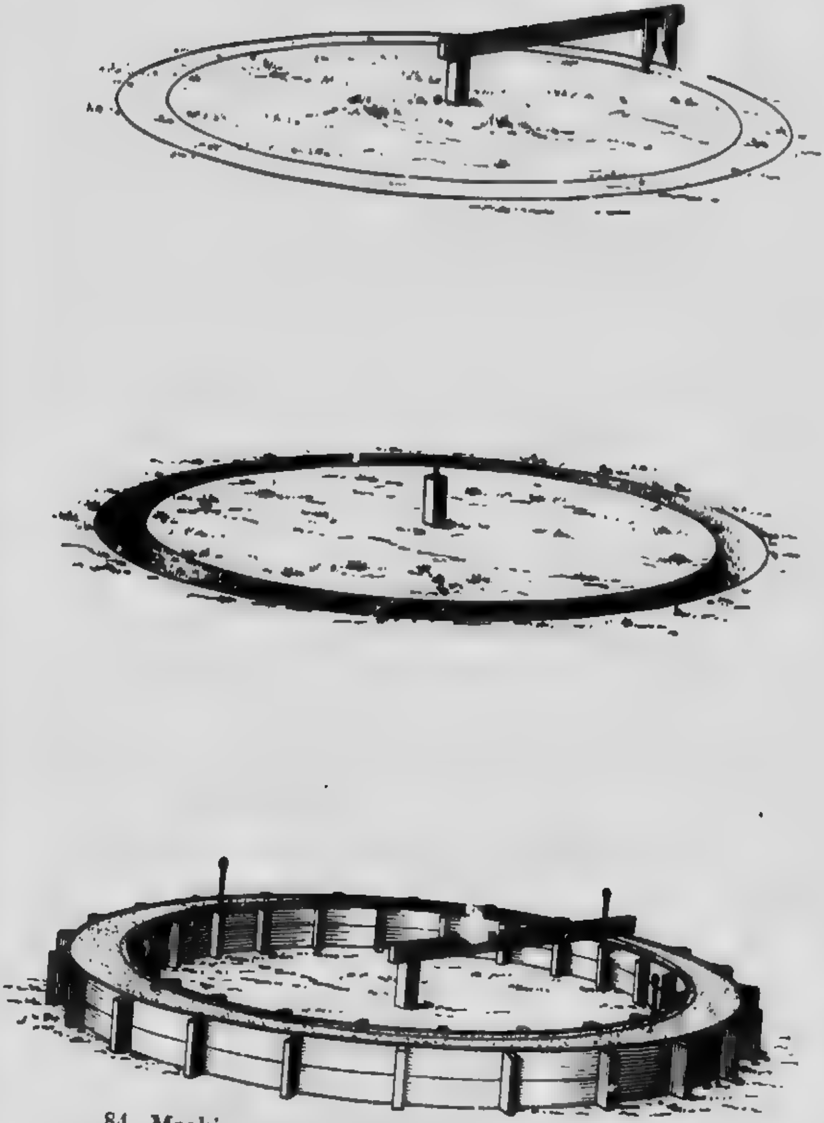
SILOS AND ENSILAGE

IMPORTANCE OF SILOS

Silos, as farm institutions, have been introduced within the last twenty-five years on many of the progressive farms in Ontario where cattle are raised either for dairy purposes or for beef. The advantages in feeding cattle with ensilage (the fodder preserved in the silo) are very great; but there are in Ontario many farmers who have still to learn that it is worth while to study the matter and install silos in connection with their stables.

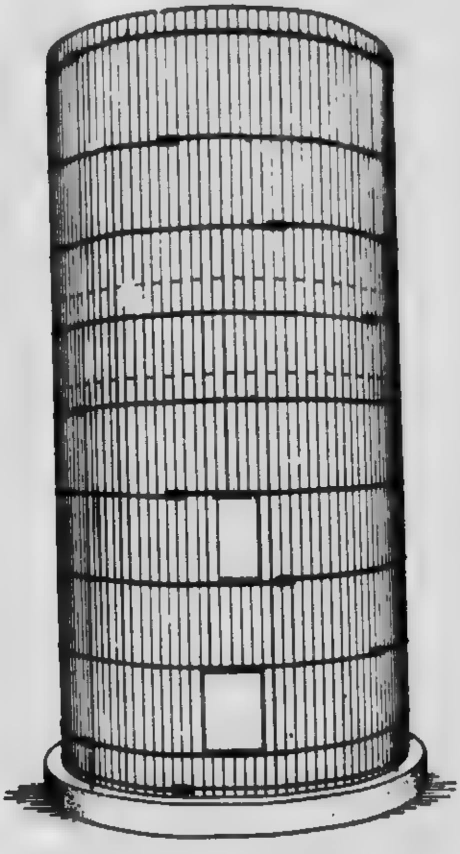
KINDS OF SILOS

There are two general types of silos now in use in Ontario—that made of concrete and that made of timber. Both are built in a cylindrical form, as a structure of this shape presents the least surface in contact with the ensilage in proportion to the amount. Moreover, it is easier to pack the green material thoroughly into the silo when it is of this shape. Where concrete is used there is some loss of ensilage around the wall, due to freezing, but this has not proved to be a serious defect. Concrete has the advantage of being more permanent than wood. The wooden silo is usually made of narrow planks placed upright and held in



84. Marking ground; trench; cement foundation

position by rods of iron bound round the outside like the hoops on a barrel. One difficulty with the wooden silo arises from the fact that wood absorbs water in one season and dries out in another, and so it is necessary to tighten up the rods when the planks dry out and loosen them when they swell. (See Figure 84 (*a*).)



84 (*a*). Wooden silo and base

In building a silo it is necessary to have it placed in a position of maximum convenience with relation to the cattle stalls. It is of some advantage also to have the bottom two or three feet below the ground level, thus lessening the height above ground. As silos are built partly in the stable, they are protected to some extent in the cold weather by the animal heat from the stable.

MATERIAL FOR ENSILAGE

The material used for ensilage purposes in Ontario is almost exclusively corn. There is no doubt that other green material could be used effectively, and it might be wise to make an effort to use other fodder to supplement the corn. Alfalfa, crimson clover, red clover, cow peas, soy beans have been used with more or less success, especially in the United States, but, after all, there is no plant that can rival corn as a crop for ensilage.

MAKING ENSILAGE

Whatever may be the material used, whether corn or not, it is cut up into small pieces by a cutting-machine, blown into the silo at the top, and then tramped down thoroughly—the more thoroughly the better—to exclude the air as much as possible. When the filling has been completed, the top of the ensilage is covered over with cut straw or some similar material, and left until needed for use after the cattle are stabled in the autumn. In filling silos farmers usually co-operate, as they do in thrashing, and have a " bee " for one man one day and for his neighbour the next, and so on. The corn, having been cut and left in the field in the sheaf a few days previously, is hauled to the cutting-machine.

After the cut material lies for a time in the silo, it undergoes a sort of fermentation up to a certain point; and decay is not possible as the oxygen of the air is excluded. Ensilage properly made will, therefore, keep indefinitely, and some farmers now put up enough ensilage to feed their dairy cows during the time of low pasture in a dry summer. Though the odour of the material is not pleasant to some people, cattle seem to grow exceedingly fond of it and, for dairy purposes, there is no more important feed known.

85. Cement silos and stock barn

ESTIMATING THE COST OF BUILDING A SILO

The cost of building a concrete silo will depend, of course, on the cost of gravel, cement, and labour. These being known, it is not difficult to calculate the cost of building the silo. For example, if a silo 10 ft. in diameter, inside measurements, 25 ft. high, and 10 in. thick, is required, the cost can be determined as follows:

$$\text{diameter outside is } 10 + \frac{10}{12} + \frac{10}{12} = \frac{35}{3} \text{ ft.}$$

$$\text{radius} = \frac{35}{6} \text{ ft.}$$

$$\text{diameter inside is } 10 \text{ ft.}$$

$$\text{radius} = 5 \text{ ft.}$$

$$\left[\left(\left(\frac{35}{6}\right)^2 \times \frac{22}{7}\right) - \left(5^2 \times \frac{22}{7}\right)\right] \times \frac{25}{1} = \text{volume}$$

$$= 709.3 \text{ cub. feet}$$

$$= 709.3 \div 27 = 26.3 \text{ cub. yards}$$

$$= 26 \text{ loads approximately.}$$

In calculating the amount of concrete, the cement and water need not be considered, as they enter the air spaces of the gravel.

If the concrete is made of a strength of 1 to 7 it will take in bags 710 ÷ 7 bags of cement. This would give 100 bags, approximately.

The cost of this silo would be the cost of 26 loads of gravel and of 100 bags of cement plus the cost of labour. This makes no allowance for the bottom which would be, say, 1½ feet thick:

$$\left(\frac{35}{6}\right)^2 \times \frac{22}{7} \times \frac{3}{2}$$

$= 160$ cu. ft. or about 6 loads;

and $160 \div 7 = 22$ bags of cement.

WOODEN SILO

The cost of lumber for a wooden silo of the same size might be estimated as follows:

Circumference $(11\frac{2}{3} \times \frac{22}{7}) \times$ height (25)
= 917 sq. ft. surface
= 917×3 (if lumber is 3 in. thick)
= 2751 feet of lumber, board measure;

and with a cement bottom, the silo would cost, in addition, what would be required for the base indicated in the concrete silo.

In both cases no allowance is made for the roof, which will be provided for as an extra, nor is any allowance made for doors or openings.

The above examples will give the farmer some idea as to the method to be employed in estimating the cost. If he can provide the gravel himself he will reduce the cost. The same may be said with respect to labour.

NOTE.—In making concrete from pit gravel it is important that the gravel be screened into *sand* (that which will pass a quarter-inch mesh) and *gravel* (one-quarter inch to two inches). Then take 1 of cement, 2 of sand, and 5 of gravel, which will make a strong concrete and will give for 2 cubic feet of sand and 5 cubic feet of gravel about 6 cubic feet of concrete. The reason for the reduction is that some of the sand enters the "voids" of the coarse material and, consequently, does not increase the bulk.

TABLE OF CONCRETE

The following table taken from a *Manual Training Course in Concrete* by The Portland Cement Association of Chicago, shows how to calculate the amounts of material for a given amount of concrete, 1 bag of cement being equal to one cubic foot and weighing 94 pounds:

Mixtures			Materials			Vol. in Cu. Ft.	
Cement	Sand	Gravel or stone	Cement in sacks	Sand cu. ft.	Gravel or stone cu. ft.	Mortar	Concrete
1	1.5	..	1	1.5	..	1.75	...
1	2.0	..	1	2.0	..	2.1	...
1	2.5	..	1	2.5	..	2.5	...
1	3.0	..	1	3.0	..	2.8	...
1	1.5	3	1	1.5	3	....	3.5
1	2.0	3	1	2.0	3	....	3.9
1	2.0	4	1	2.0	4	....	4.5
1	2.5	4	1	2.5	4	....	4.8
1	2.5	5	1	2.5	5	....	5.4
1	3.0	5	1	3.0	5	....	5.8

FEEDS FOR STOCK

FUNDAMENTAL USE OF FOOD

Food, as a general rule, supplies the material to build up and maintain the substance of the body, to supply energy, and to maintain heat in co-operation with oxygen from the air. If more material is taken in than can be used to repair the waste supply and the needed energy and heat, growth is the result. This growth may mean the increase in size that the animal undergoes in reaching maturity, or it may mean the increase in fat and flesh which, in ordinary terms, is called fattening.

CHIEF CONSTITUENTS OF FOOD

The value of a food in animal economy will depend on the needs of the animal and the composition of the food with respect to these needs. Three general types of food are recognized—nitrogenous foods, carbohydrates, and fats. Fats and carbohydrates are required largely to maintain the body temperature and to supply energy for the activities of the animal. The nitrogenous foods which contain protein as the most important constituent, contribute largely toward the production of muscle or lean meat.

86. Dairy stable

PROTEIN is considered the most important and costly of the three, and is contained in beans, peas, oil-cake, hay, grass, etc.; and, in small quantities, it is found in a wide range of foods. The protein content of a food is the chief factor in determining the value.

CARBOHYDRATES include the starches and cellulose, and are found quite generally in plant substances, though never in animal food. These contribute largely toward keeping up animal heat and also in supplying muscular energy.

87. Guernsey cow, clipped for cleanliness in milking

88. A well-lighted, well-ventilated, clean, cow barn

Fats are common in a great variety of plants and contribute as a food toward the supply of heat and energy. They are somewhat different in composition from the carbohydrates, though they both contain only carbon, hydrogen, and oxygen. However, the fats contain, for a given weight, about 2¼ times as much heat energy as the carbohydrates. Both carbohydrates and fats serve as a source of fat for the animal, which stores it up in several places in its body, notably under the skin, around the kidneys and intestines, and among the fibres of the muscles.

89. Type of milking machine in operation

SUITABLE PROPORTIONS OF THE CONSTITUENTS

Balanced rations are those arranged in the proper proportions of protein, carbohydrates, and fats, to meet the requirements of the animal for a given purpose. But the chemical composition does not always indicate the food value; as some chemical compounds are more digestible than others. Digestibility should, therefore, be taken into account.

90. Well-ploughed land

NUTRITIVE RATIO

A nutritive ratio is the proportion of digestible protein and digestible carbohydrates and fats in a given food. Considering that the food value of fat is 2¼ times as great as that of a given weight of carbohydrates, the relationship can be expressed in a simple mathematical statement. For example, corn contains 67% of carbohydrates, 8% of protein, and 4.5% of fats. Calculating the fat in terms of the carbohydrates we have 4.5×2.25=10.125. Thus we have 67 + 10.125 = 77.125 of carbohydrates. The nutritive ratio will be, therefore, 8 (protein): 77.125 (carbohydrates) or 1:9.89, which is approximately 1:10.

The ratio found by experiment to be most suitable is given below. A good deal of difference of opinion exists in regard to these figures, but the principle may be readily understood from the following:

Heavy working horses, 1:6
Horses on very light work, 1:7
Mature milking cows, 1:7
Young beef cattle (1 year), 1:6
Older beef cattle (2 year), 1:7
Young pigs (3 mo.), 1:4
Older pigs (12 mo.), 1:7.5
Mutton sheep (6 mo.), 1:4.8
" " (20 mo.), 1:6.5
Mature sheep, 1:9

All ordinary stock foods, such as grass, grain, hay, etc., contain protein, carbohydrates, and fats, but, excepting grass, they do not contain them in the proper proportions for the best results in feeding. When the foods are so arranged that the amount of each of the chief constituents is suitable for the needs of the animal, it is called a *balanced ration.* To provide this requires some study on the part of the feeder. As indicated in the above list, a working horse requires a different ration from that of a horse standing in the stable.

Table Showing the Digestible Food Constituents in 100 Pounds (Other Constituents not Considered)

	Carbohydrates	Fats	Protein
Clover hay	38.16	1.8	5.41
Timothy hay	43.71	1.44	2.05
Corn ensilage	14.56	.89	1.22
Alfalfa hay	37.33	1.37	6.94
Oat straw	38.63	.76	1.1
Bran	41.23	2.88	10.2
Turnips	6.46	.11	.22
Mangels	5.65	.11	.14
Oats	48.34	4.17	8.35
Corn	62.12	4.97	6.79
Linseed meal	32.80	7.06	27.52

The pupils should calculate the nutritive ratio from the above data.

FERTILIZERS

GENERAL FERTILIZERS FOR SOILS

A fertilizer is a material applied to the soil for the purpose of increasing the crop. The general notion with regard to the use of a fertilizer is that the substance added to the soil is taken in by the plant; it is often erroneously called plant food. Roughly speaking, plants contain carbon, water, nitrogenous compounds, and ash. A large proportion of a green plant, perhaps 90% to 95% by weight, is composed of carbon and water. Carbon is obtained from the air in the form of carbon dioxide, and not from the soil. The water is obtained from the soil, and in it are very small quantities of substances in solution, which, though very small in amount, are necessary for the proper development of the plant. Nitrates in the soil supply the nitrogen, phosphates the phosphorus, sulphates the sulphur, and various other compounds supply the potassium, magnesium, iron, and calcium.

ESSENTIAL ELEMENTS FOR PLANTS

Green plants require ten elements—carbon, oxygen, hydrogen, nitrogen, sulphur, phosphorus, potassium, calcium, magnesium, and iron. Most of these substances are universally present, consequently there is no concern as to the supply. The elements which are likely to vary and therefore require attention by the farmer are potassium, phosphorus, nitrogen, and occasionally calcium; therefore the fertilizer problem is one concerned with these substances. Commercial fertilizers are supposed to contain the three elements, potassium, phosphorus, nitrogen, and in a form that may be more or less readily soluble. Certain soils may be improved by the addition of compounds containing some one of these without the others. This can be determined only by experiment on the land itself.

COMMON FERTILIZERS

The common forms of fertilizers are—barnyard manure, green manure, prepared offal from slaughterhouses, dried blood, guano, nitrate of soda, phosphates, and super-phosphates of lime, potassium compounds, basic slag, bone meal, and a great variety of other substances.

PLANT EXCRETA AS CAUSES OF INFERTILITY

The chief causes of soil becoming poor and unproductive are—(*a*) it contains excreta from other plants, and (*b*) the physical texture has become unsuitable. These causes are remedied largely by cultivation, by adding barnyard manure, by ploughing down green crops, and by proper under-drainage. They may also be remedied to a certain extent by the application of certain commercial fertilizers.

LIME AS A FERTILIZER

The use of calcium compounds, such as lime or limestone, as fertilizers, is attracting more and more attention in recent years. The chief uses of lime are—(*a*) to neutralize any acidity, (*b*) to improve (for clay soil) the physical condition, and (*c*) to liberate potassium from certain chemical compounds already in the soil.

CAUTION IN THE USE OF COMMERCIAL FERTILIZERS

Every farmer should be very cautious about the use of commercial fertilizers; much money is wasted every year in the indiscriminate use of them. Those who sell fertilizers by the use of full page advertisements in magazines are, of course, anxious to dispose of their product; but the farmer should consider his own interests first, and use such fertilizers as have been proved, by experiment on his own farm, to be adapted to the soil.

LEGUME CROPS AS FERTILIZERS

The enriching of soil in respect to nitrogen by growing some legume crops, such as clovers, beans, peas, alfalfa, etc., is one of the most important means by which the farmer may build up his soil. The roots of such crops as these harbour a low form of plant as a parasite in the tissues, which produces tubercles and nodules. These nodules contain within the cells of the tissues countless millions of bacteria, which have the power of causing the union of the nitrogen of the air (held among the particles of soil) with other elements, thus forming compounds containing nitrogen as one constituent. These compounds are, later on, available for crops grown in this soil. Atmospheric nitrogen, therefore, through the agency of these minute organisms, may be made use of by plants. About four fifths of the atmosphere is nitrogen, though plants cannot make use of it directly. It is all-important, therefore, that farmers should grow clover as one of their crops.

The chief thing for the farmer to consider is that the fertility of the land is largely under his own control. Fertility may be improved by (*a*) under-drainage, (*b*) cultivation, (*c*) autumn ploughing, (*d*) rotation of crops, (*e*) ploughing down green crops, (*f*) applying a suitable commercial fertilizer, and (*g*) applying barnyard manure.

ACT FOR THE PROTECTION OF INSECTIVOROUS AND OTHER BIRDS

NOTE.—The following should be read and explained to the pupils two or three times during spring and early summer.

Chapter 289, R.S.O. 1897

HIS MAJESTY, by and with the advice and consent of the Legislative Assembly of the Province of Ontario, enacts as follows:

1. Nothing in this Act contained shall be held to affect *The Ontario Game Protection Act*, or to apply to any imported cage birds or other domesticated bird or birds generally known as cage birds, or to any bird or birds generally known as poultry.

2.—(1) Except as in section 6 of this Act provided, it shall not be lawful to shoot, destroy, wound, catch, net, snare, poison, drug, or otherwise kill or injure, or to attempt to shoot, destroy, wound, catch, net, snare, poison, drug, or otherwise kill or injure, any wild native birds other than hawks, crows, blackbirds, and English sparrows, and the birds especially mentioned in *The Ontario Game Protection Act*.

(2) Any person may, during the fruit season, for the purpose of protecting his fruit from the attacks of such birds, shoot or destroy, on his own premises, the bird known as the robin without being liable to any penalty under this Act.

3. Except as in section 6 of this Act provided, it shall not be lawful to take, capture, expose for sale or have in possession any bird whatsoever, save the kinds hereinbefore or hereinafter excepted, or to set wholly or in part any net, trap, spring, snare, cage, or other machine or engine, by which any bird whatsoever, save and except hawks, crows, blackbirds and English sparrows, might be killed and captured; and any net, trap, spring, snare, cage, or other machine or engine, set either wholly or in part for the purpose of either capturing or killing any bird or birds save and except hawks, crows, blackbirds and English sparrows, may be destroyed by any person without such person incurring any liability therefor.

4. Save as in section 6 of this Act provided, it shall not be lawful to take, injure, destroy, or have in possession any nest,

young, or egg of any kind whatsoever, except of hawks, crows, blackbirds, and English sparrows.

5. Any person may seize, on view, any bird unlawfully possessed, and carry the same before any justice of the peace, to be by him confiscated, and if alive to be liberated; and it shall be the duty of all market clerks and policemen or constables on the spot to seize and confiscate, and if alive to liberate, such birds.

6. The chief game warden for the time being, under *The Ontario Game Protection Act*, may on receiving from any ornithologist or student of ornithology, or biologist, or student of biology, an application and recommendation according to the forms A and B in the schedule hereto, grant to such an applicant a permit in the form C in said schedule, empowering the holder to collect, and to purchase or exchange all birds or eggs otherwise protected by this Act, at any time or season he may require the same for the purposes of study, without the liability to penalties imposed by this Act.

7. The permits granted under the last preceding section shall continue in force until the end of the calendar year in which they are issued, and may be renewed at the option of the chief game warden for the time being under *The Ontario Game Protection Act*.

8.—(1) The violation of any provisions of this Act shall subject the offender to the payment of not less than one dollar and not more than twenty dollars, with costs, on summary conviction, on information or complaint before one or more justices of the peace.

(2) The whole of the fine shall be paid to the prosecutor unless the convicting justice has reason to believe that the prosecution is in collusion with and for the purpose of benefiting the accused, in which case the said justice may order the disposal of the fine as in ordinary cases.

(3) In default of payment of the fine and costs, the offender shall be imprisoned in the nearest common gaol for a period of not less than two and not more than twenty days, at the discretion of the justice.

9. No conviction under this Act shall be quashed for any defect in the form thereof, or for any omission or informality in any summons or other proceedings under this Act so long as no substantial injustice results therefrom.

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